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Plastics

DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS

#196

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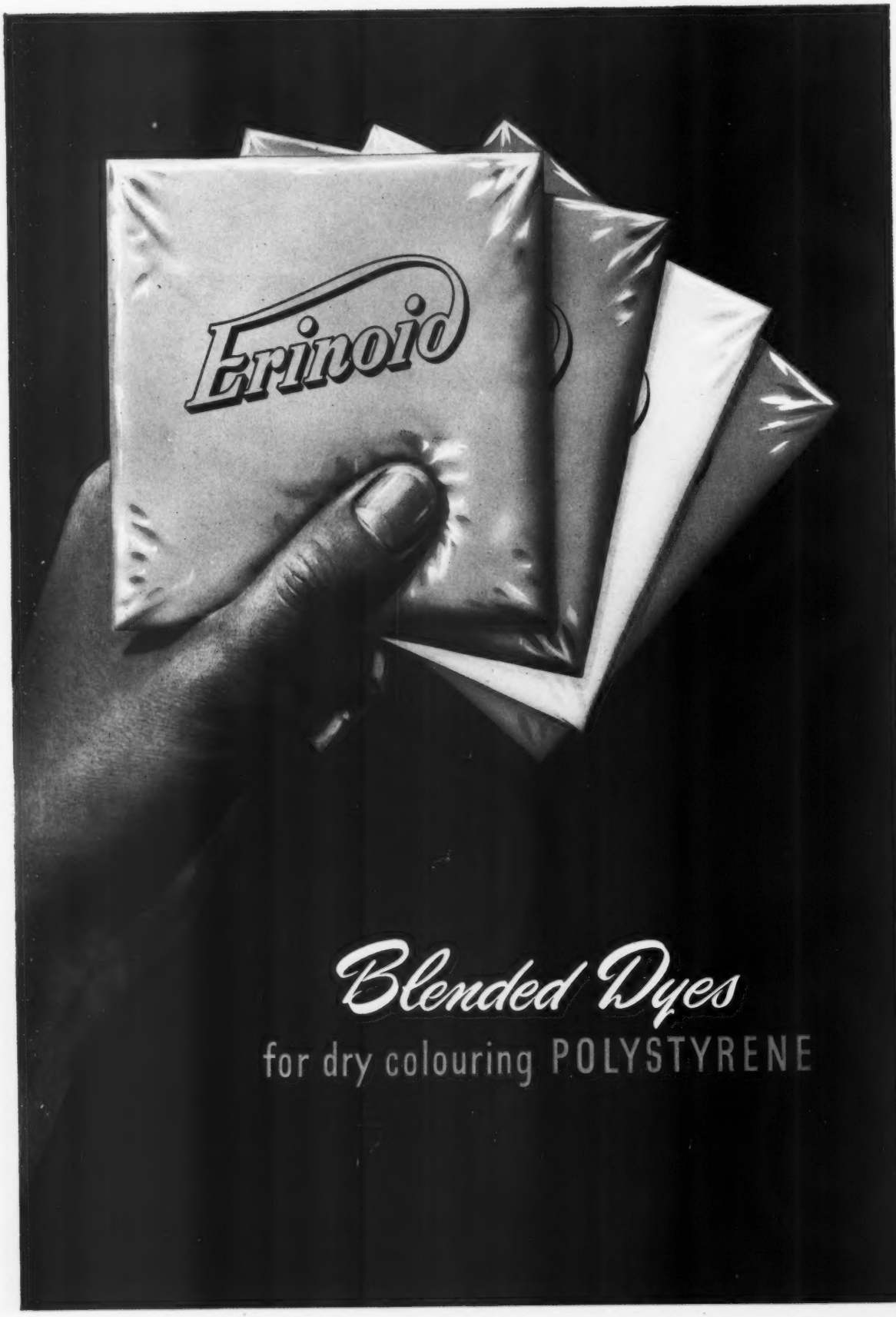
Erinoid
Blended Dyes
for dry colouring POLYSTYRENE

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Are you harbouring scrap P.V.C., Cellulose Acetate, Polyethylene, Polystyrene or "Perspex"? We welcome all clues that lead us to these, or any kind of thermoplastic scrap and surplus material. Let us know the kinds and quantities you have to offer.

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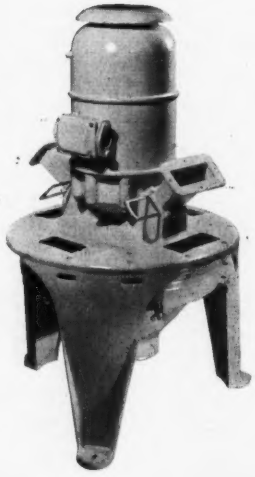

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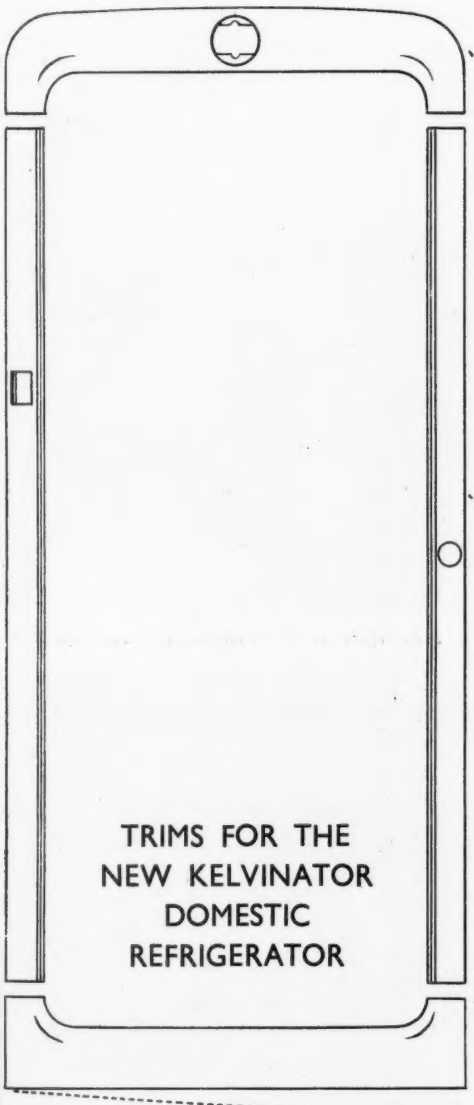

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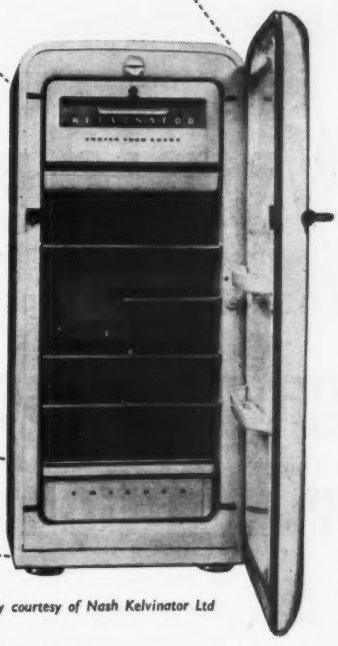

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Photographs by courtesy of the de Havilland Aircraft Co. Ltd.

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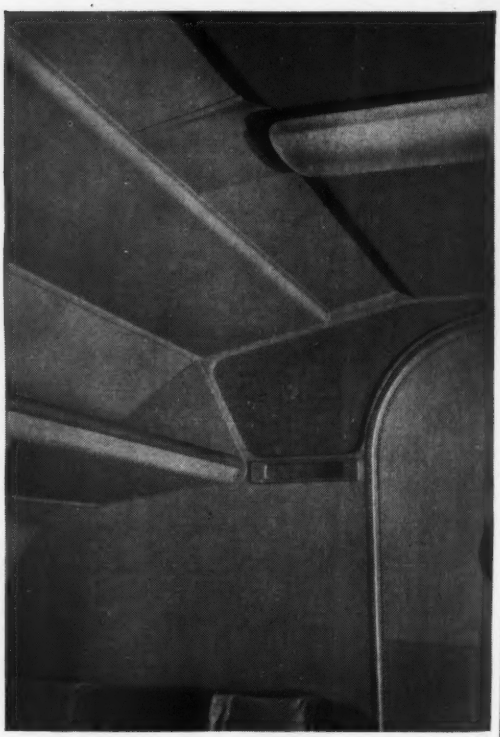

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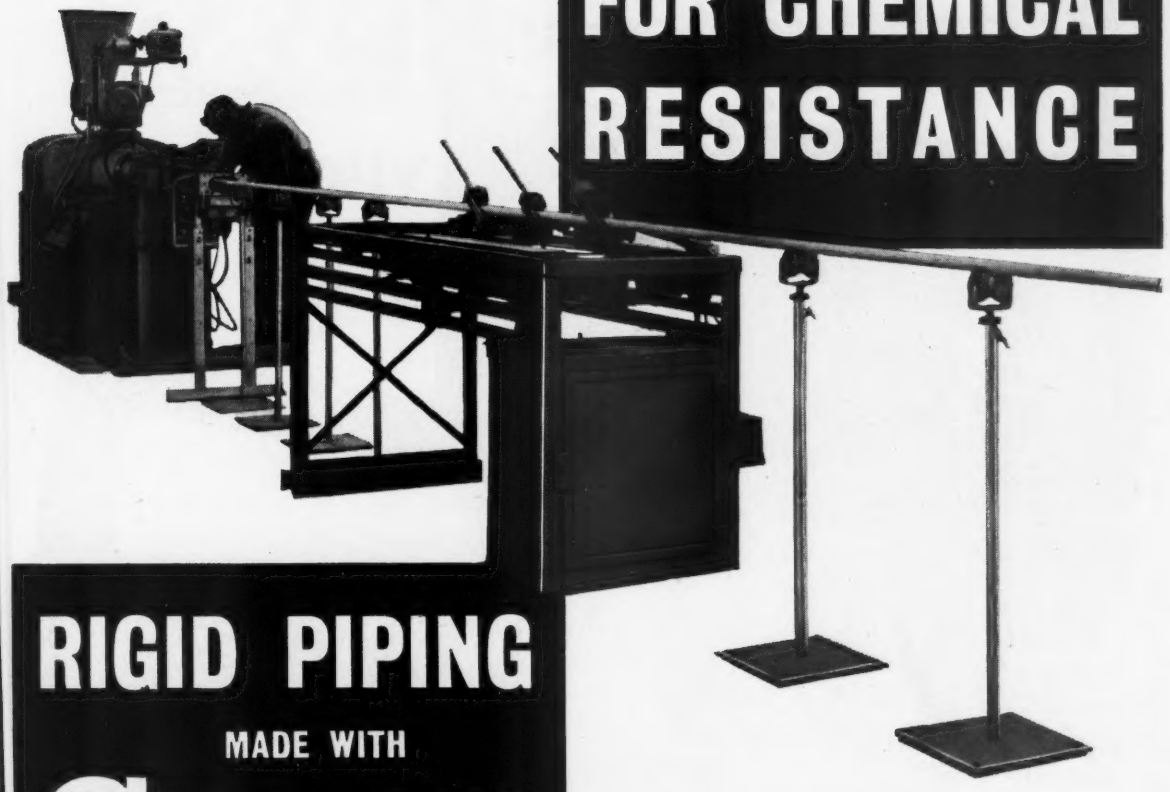

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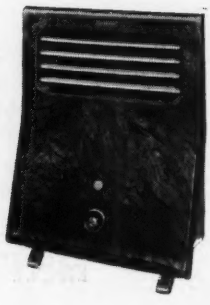

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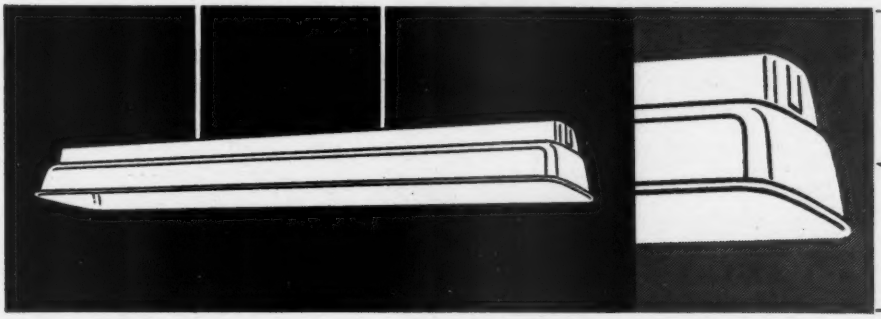

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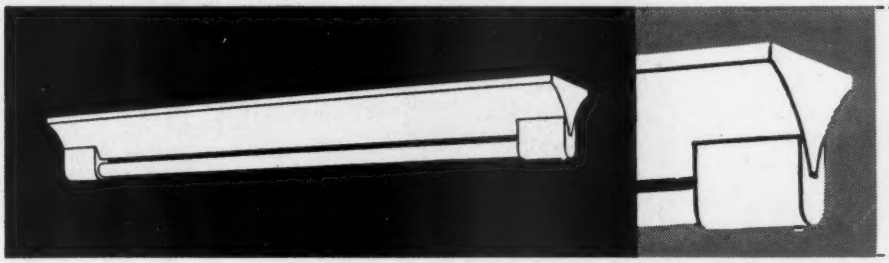

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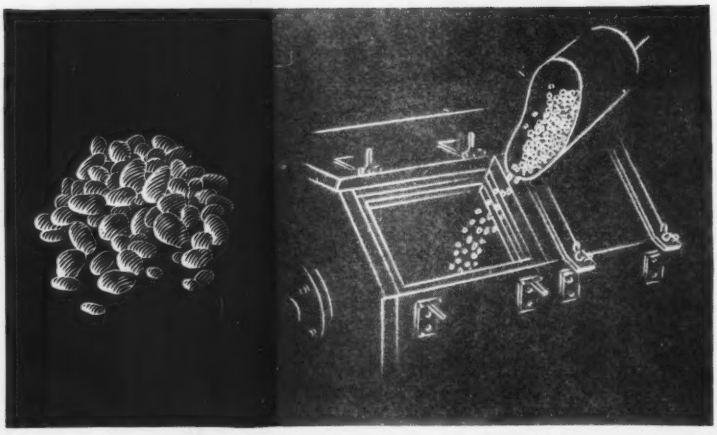

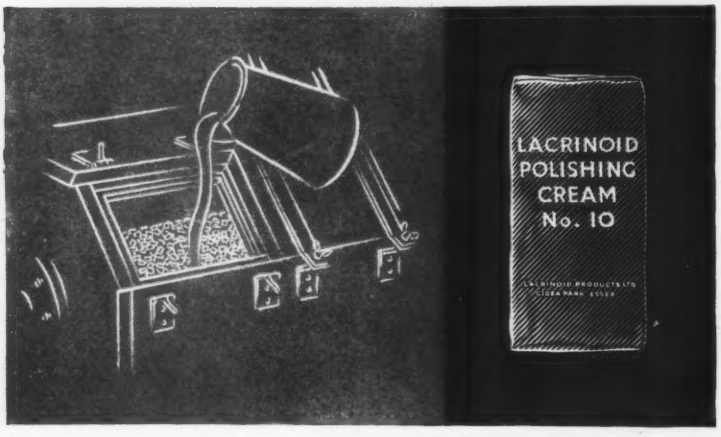

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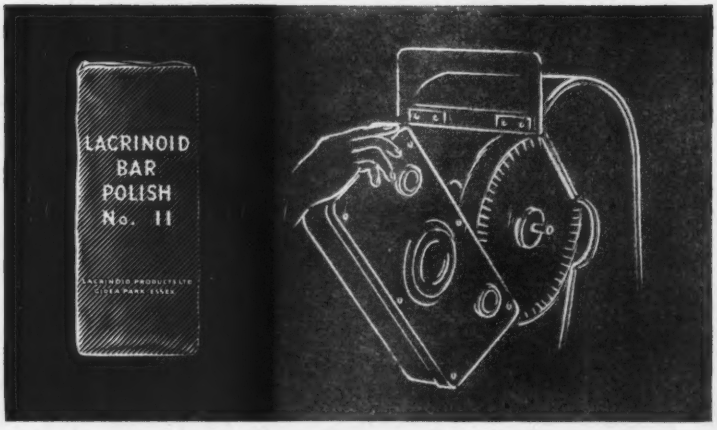

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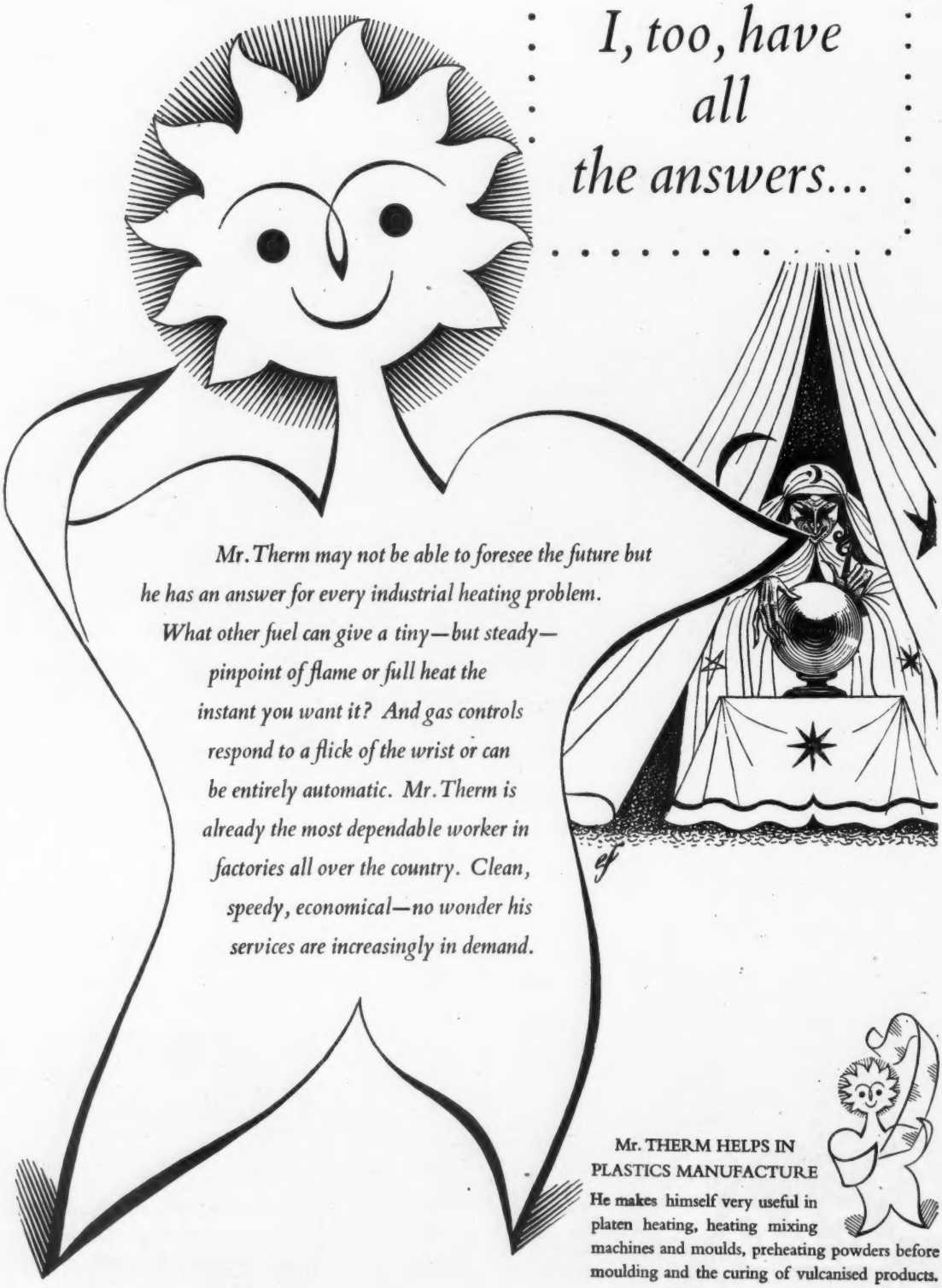

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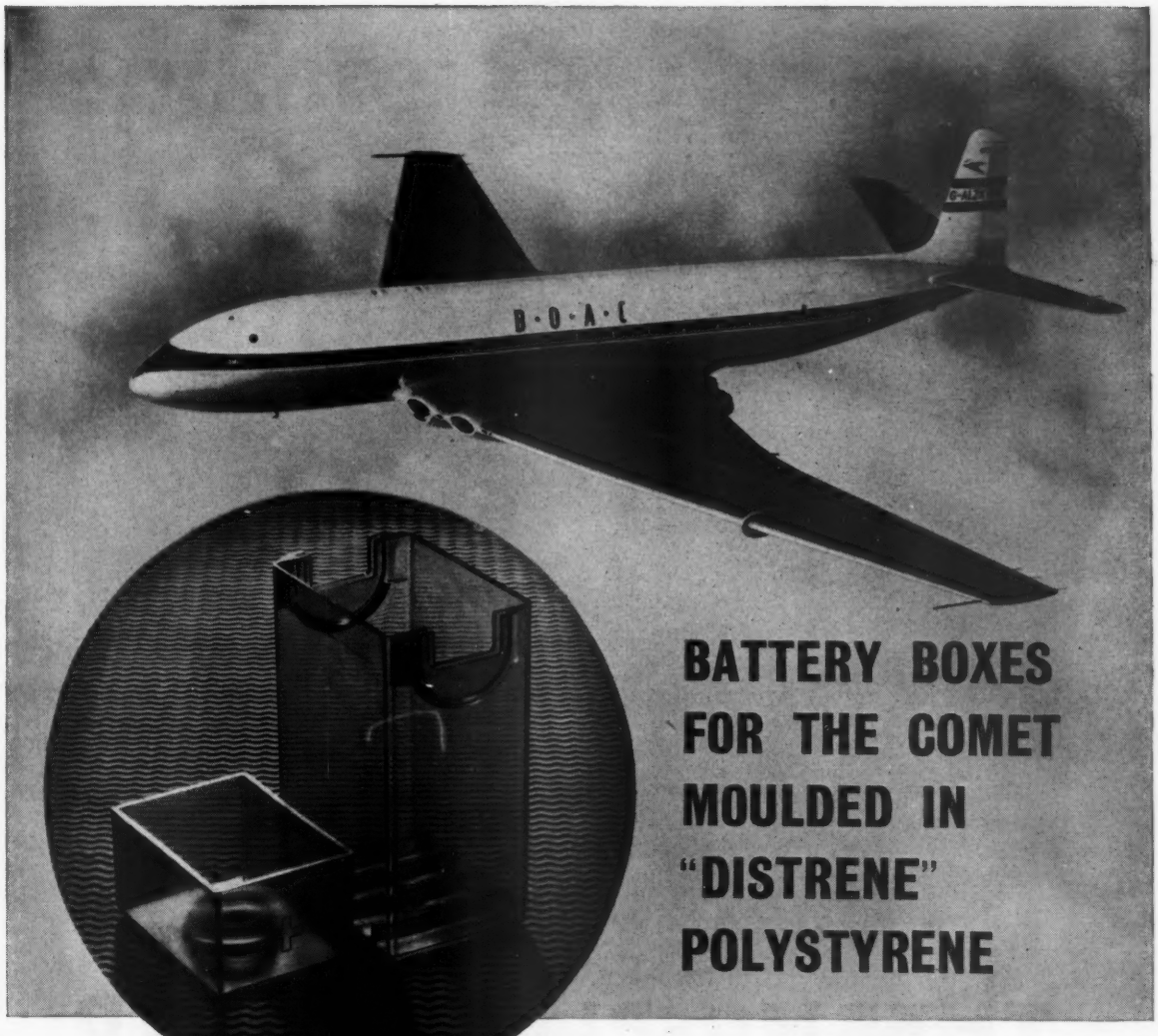

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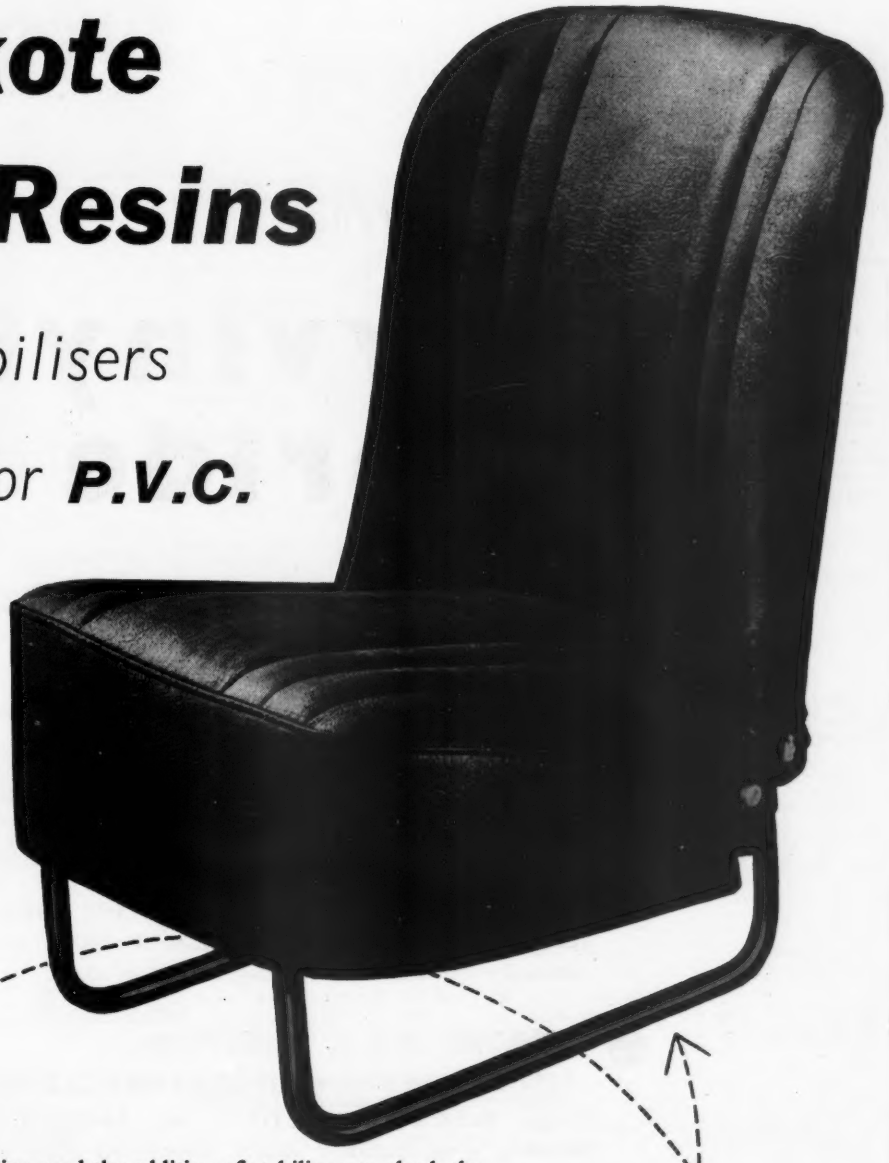

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V32

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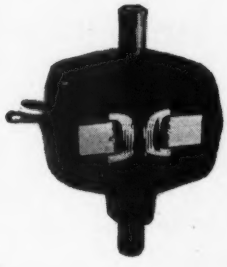

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'Araldite' type 15	hot setting	thin adhesive film high strength	bonding electrical laminations
'Araldite' type 101	cold setting		bonding non-porous materials when heat cannot be applied
'Araldite' type 102	cold setting		bonding materials, one of which must be porous
'Araldite' D	cold or hot setting	solvent free, higher strength than obtainable with types 101 and 102	bonding non-porous materials
'Araldite' casting resins			
'Araldite' B	hot setting	high mechanical and electrical strength low shrinkage	potting electrical equipment. Pre-formed insulating materials
'Araldite' D	cold or hot setting		potting electrical equipment which cannot be heated
'Araldite' F	cold or hot setting	low viscosity	penetration into fine windings
'Araldite' fillers			
'Araldite' cold setting filler		good adhesion to metals	filling depressions in metal surfaces
'Araldite' hot setting filler		solvent free no shrinkage	filling weld channels in motor car bodies
'Araldite' coating resins			
'Araldite' 970 Bn	hot setting	flexibility and adhesion	coating wire for electrical industry
'Araldite' 985E	hot setting	hardness, flexibility, chemical resistance and adhesion	protection of metal surfaces (especially in paint industry)
recently developed forms of 'Araldite' for evaluation			
'Araldite' flexible adhesive 33/896	hot setting	permanent flexibility	joining dissimilar materials, e.g., glass and metal
'Araldite' flexible casting resin 33/896	hot setting	permanent flexibility	potting electrical equipment in a non-rigid medium
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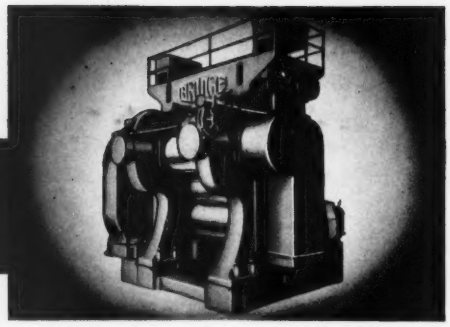
Precision Calender with three superimposed and one offset roller. Flood lubrication.



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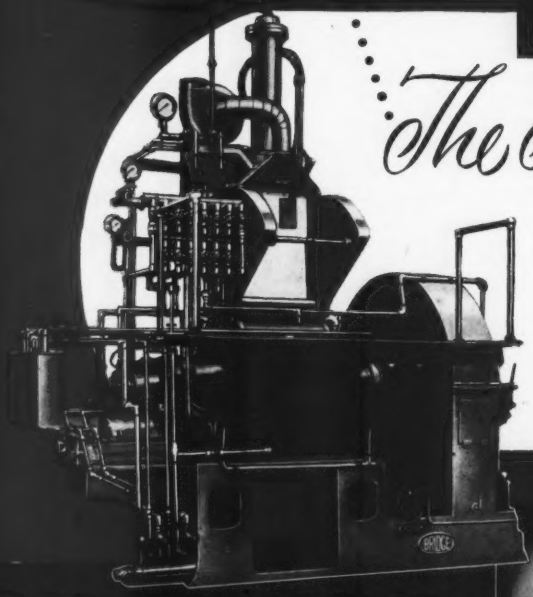
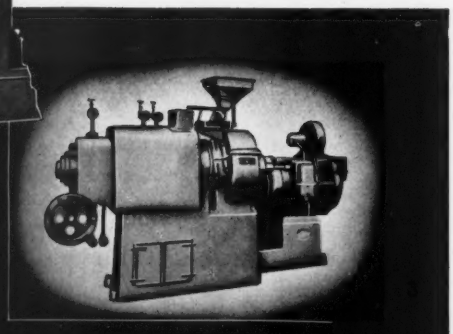


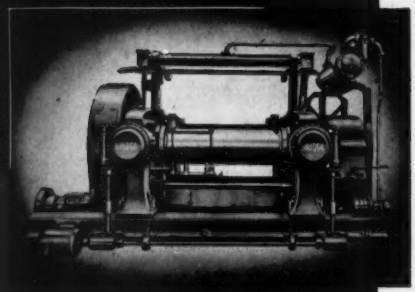
The Bridge — Banbury Patent Mixer. (1)

4½" Cold Feed Plastics Extruder. (3)



Precision Calender with four superimposed rollers. Flood lubrication. (2)

High temperature 22" x 60" Plastics Mill with flood lubrication. (4)



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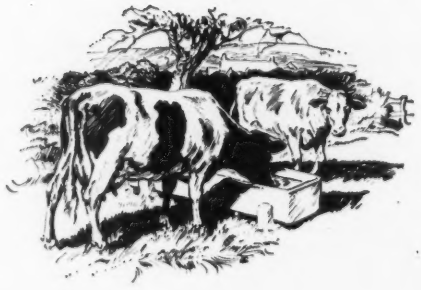
I.C.I. PLASTICS

Serve the Farmer

Modern farming techniques call for hygienic and well-lit barns, byres and sheds. To ensure the maximum daylight in their out-buildings farmers specify corrugated 'Perspex'. This acrylic sheet is simple to fix, is available to match any standard roofing corrugations, whether the roof is straight or rounded and transmits no less than 92% of natural light. When used for cattle sheds it benefits the stock too, since corrugated 'Perspex' transmits health-giving ultra violet light.

I.C.I. also serves the farmer by supplying tough, flexible 'Alkathene' tube, made from the I.C.I. brand of polythene. This tubing answers the farmers' need for water service lines that are adaptable and easy to install, durable as conventional 'permanent' materials, proof against frost bursts and immune to corrosion from soils or water.



'Perspex' and 'Alkathene' are registered trade marks, the property of Imperial Chemical Industries Ltd.

IMPERIAL CHEMICAL INDUSTRIES LIMITED, LONDON, S.W.1

Export enquiries should be addressed to : Imperial Chemical Industries Ltd., Plastics Division, Black Fan Road, Welwyn Garden City, Herts, England.

P.528

An Honour Thrust Upon Us!

Readers of our announcements are by now familiar with the recent causes that led up to "Nestorite" being promoted to the ranks of the Immortals, and thus our increasingly intimate friendship with them.

Although Jupiter (Jove), Apollo, Mercury and associates are not yet on our Board of Directors, they are taking an increasingly active interest in our welfare and progress.

A case in point is a recent intimate talk we had with Jupiter. He explained the meaning of the symbol "R" used in medical prescriptions. "R", the initial letter of the Latin word "Recipe" (Take) and preceding descriptions of the ingredients. To safeguard Physicians against "quack" imitations, Jupiter (Jove) granted them the right to use his initial—as a mark of genuineness—hence . . . said Jupiter wearily: "*I granted this concession to Latin medicos who wrote their prescriptions in clear Roman characters, but I never reckoned on the prescriptions written today in hieroglyphics which only chemists can read. Because "Nestorite's" formulæ are clear and legible I grant you the right henceforth to use the symbol . . ..certifying that they are RIGHT, by JOVE!—as your customers are RIGHT with NESTORITE.*"

NESTORITE	GRADE A.578/1
Filler	Asbestos
Particle Size	Fibrous
Specific Gravity	1·90
Bulk Factor	10—16
Powder Density	·12—·18
Time of Cure of Test Cup (secs.)	120—150
Recommended flow range	5—8
Shrinkage (thou./in.)	1·5—3·0
Flowability (cm.)	7—8
Impact Strength (ft./lb.)	·45—·60
Tensile Strength (lb./sq. in.)	5,000—8,000
Water Absorption (7 days) (mg.)	100—200
Heat Resistance (½ hr. at 400°C.) (lb.)	500
Plastic Yield Grading (°C.)	180
Blister Temperature (50°C per hr. rise)	200—210
Shrinkage after heating 5-in disc for 24 hrs. at 180°C. (thou./in.)	1·5
Electric Strength at 90°C. minute value (V/mil)	10—30
Surface Resistivity after immersion ($\log_{10}$ohms)	8·0—9·0
Volume Resistivity (as moulded) ($\log_{10}$ ohm cm.)	8·0—9·0

A resin-asbestos material suitable for mechanical articles where continuous heat resistance is required. Fluff, but can be "snowballed".

YOU'RE RIGHT WITH "NESTORITE"

JAMES FERGUSON & SONS LTD.

LEA PARK WORKS, PRINCE GEORGE'S RD., MERTON ABBEY, LONDON S.W.19.

Telephone MITCHAM 2283 (5 LINES) *Telegrams* NESTORIUS SOUPHONE LONDON

A. S. HARRISON & CO. PTY. LTD.,
85, Clarence St., Sydney, Australia.
120, Wakefield St., Wellington, New Zealand.

ANDRE BERJONNEAU,
134, Avenue de Villiers, Paris 17, France.

JOSE DELCLOS MOLLERA,
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EINAR HOLMARK, 19, Gl. Kongevej,
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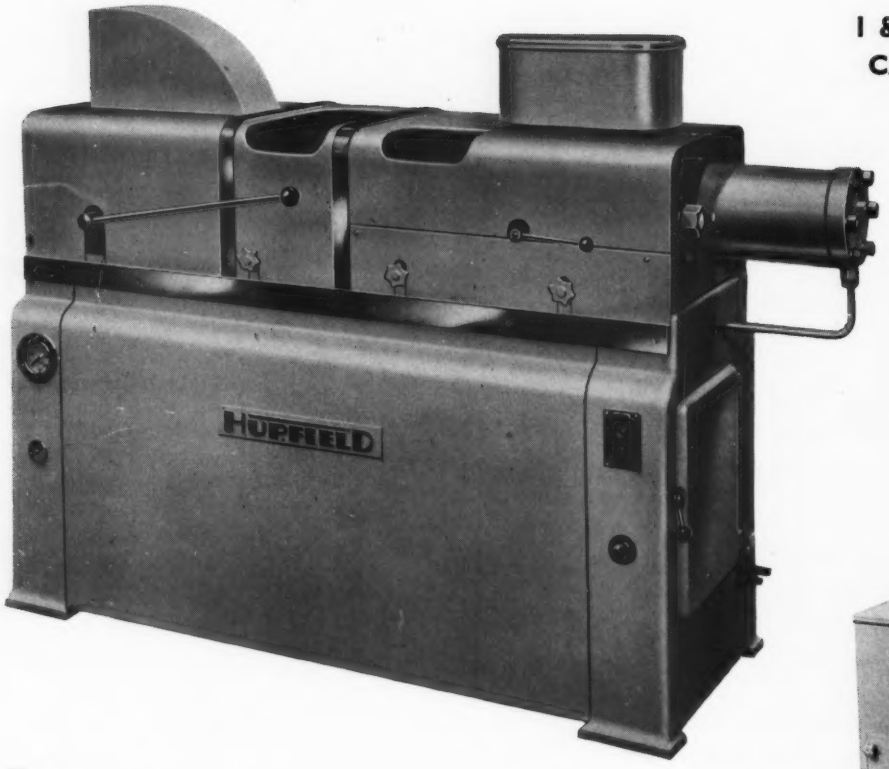
HUPFIELD

Plastics

INJECTION MOULDING MACHINES
FOR ECONOMICAL PRODUCTION

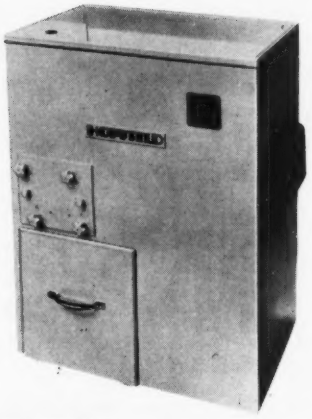
I & 2 OUNCE
CAPACITIES



These
low priced hydraulic
operated moulding machines, are
designed for the rapid production of thermo-
plastic mouldings on a low cost basis. Being operated by a single lever they are simple to use, ideal for female labour. Fitted with compensating feed mechanism and the latest Tem-Con automatic temperature control. All parts are standardized.

Completely self-contained with electric motor.

Machine moulding capacity	1 oz.	2 oz.
Moulding area up to	12 sq. in.	22 sq. in.
Plasticizing capacity per hour	11 lb.	22 lb.
Shots, subject to mould design	350 per hr.	250 per hr.



This
fully enclosed machine
will granulate any type of thermo-
plastic material, is very rapid and smooth in action. The cutting blades are adjustable and can be very quickly cleaned.
Completely self-contained with 2 H.P. electric motor.

Write for particulars, or telephone our Works (Wordsworth 4488) for a demonstration.

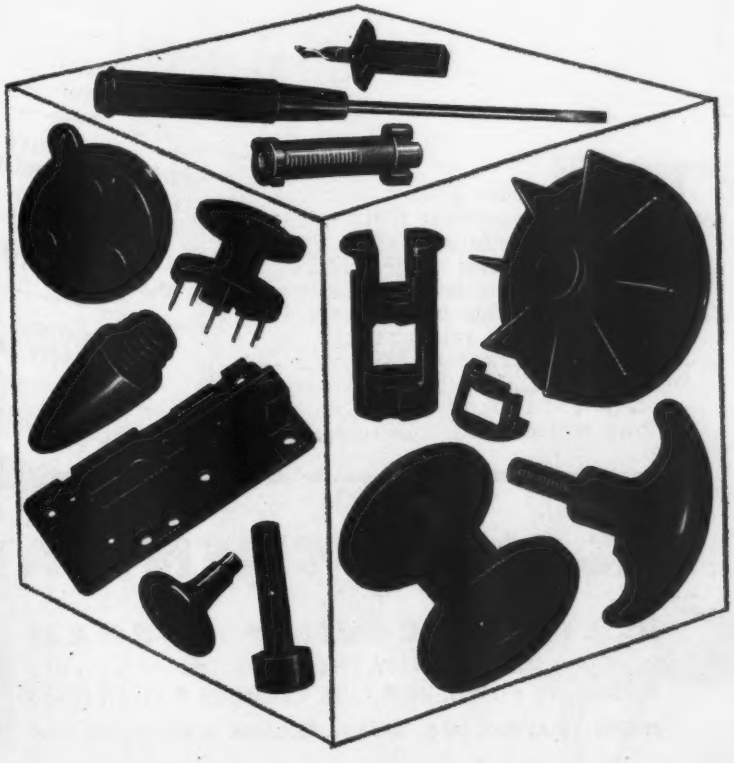
HUPFIELD BROTHERS LIMITED WORKS AND OFFICES
DALSTON GARDENS · STANMORE · MIDDLESEX · ENGLAND

We're completely self-contained!

FROM BLUE-PRINT STAGE TO THE FINISHED PRODUCT . . . your problems are solved under one roof.

We design your mouldings, make the tools and are in production in the shortest possible time. Our specialised knowledge has been gained through many years of meeting the needs of all industries. Our skilled technicians have at their command the most up-to-date precision equipment in tool room and moulding shop. Be it a small order for an intricate design, or an extensive run of a comparatively simple job . . . the fact that we're completely self-contained means that our prices are competitive, our service reliable and our workmanship first class.

**Whatever you need in plastic mouldings we are confident that we can supply it. We welcome ALL enquiries*



ROOTES

Contractors to M.O.S., *Admiralty, etc.,* A.I.D. *approved*

SLOUGH · BUCKS TELEPHONE : SLOUGH 22349

Smee's R182

D

RCL MOULDING POWDERS

FM.2 BLACK

POWDER DENSITY (gms/cc)	0.39
BULK FACTOR	3.5
PELLETING PROPERTIES	CANNOT BE PELLETED
SHRINKAGE (inch/inch)	.005—.007
DENSITY OF MOULDINGS	1.35
IMPACT STRENGTH (ft./lbs.)	0.28—0.32
TENSILE STRENGTH (lbs./sq.inch)	6000—8000
WATER ABSORPTION (mgms)	110—150
ELECTRIC STRENGTH @ 90°C. (volts/mil)	50—80
ELECTRIC STRENGTH @ 20°C. (volts/mil)	150—250
SURFACE RESISTIVITY (megohms/cm²) (1) FRESHLY MOULDED (2) AFTER 24 HRS. IN WATER	10^4—10^5 10^3—10^4
VOLUME RESISTIVITY (megohms/cm³)	10^5—10^6
CURE : SECONDS TO OBTAIN A BLISTER FREE CUP	70—75
MOULDING TEMPERATURE	300°F—330°F

FM.2 is a pure phenol, medium shock resisting powder with a cellulose filler. It conforms to BSS 771 : 1948, Type MS and is specifically recommended for use in connection with CS 1790E. This powder can be A.I.D. and C.I.A. released and is approved against the radio components specification RCS 1000, grade 5b. Supplied in a wide range of flows in black and various colours

RESINOUS CHEMICALS LIMITED

BLAYDON, COUNTY DURHAM

VARNISH MEDIA • SYNTHETIC RESINS AND GLUES
MOULDING POWDERS • FINE COLOURS • CHEMICALS

PHONE: BLAYDON 347-8. GRAMS: RESCHEM, BLAYDON-ON-TYNE

RCL

The **Windsor**

SINGLE STAGE
MULTI-SCREW

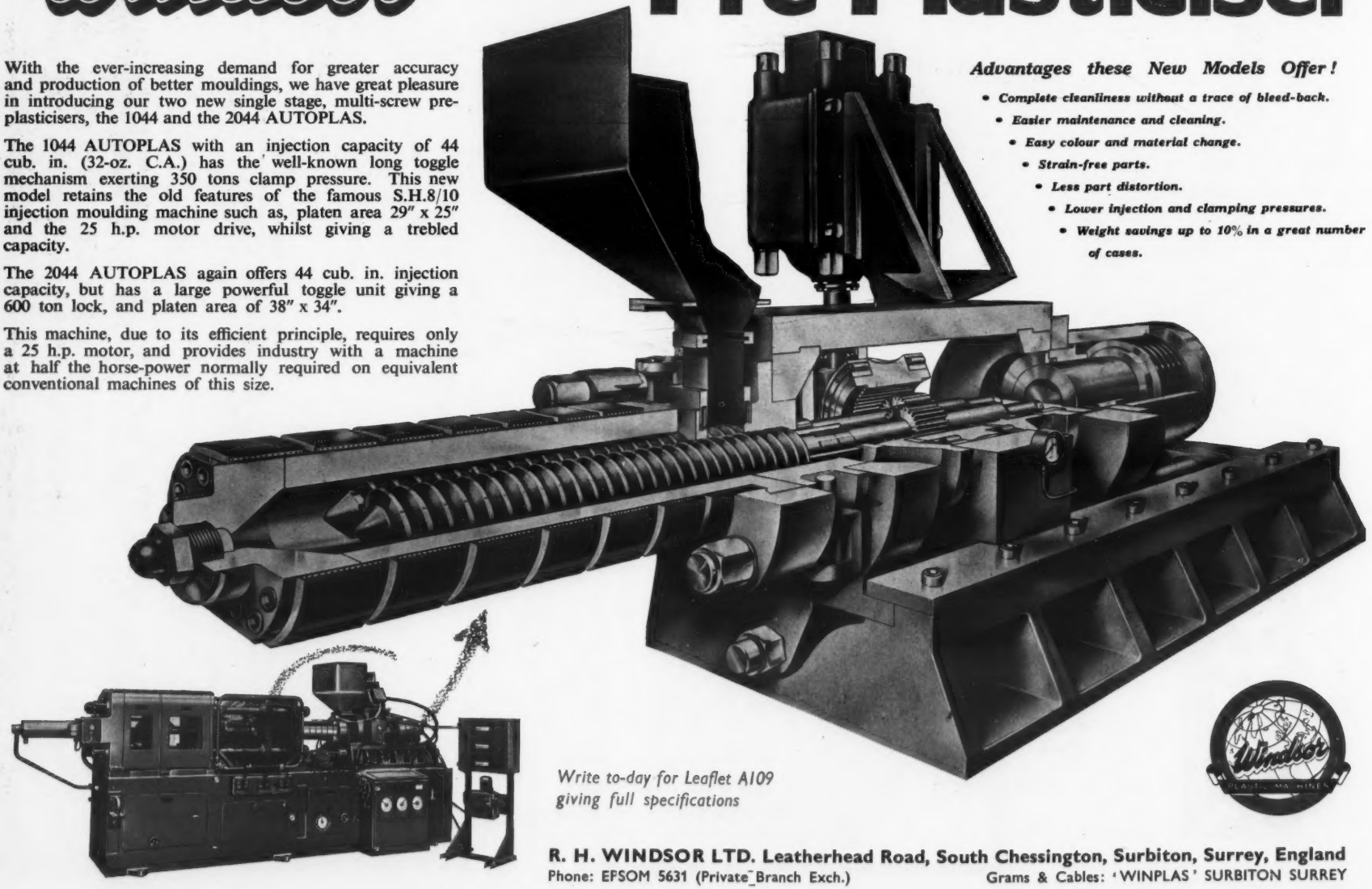
Pre-Plasticiser

With the ever-increasing demand for greater accuracy and production of better mouldings, we have great pleasure in introducing our two new single stage, multi-screw pre-plasticisers, the 1044 and the 2044 AUTOPLAS.

The 1044 AUTOPLAS with an injection capacity of 44 cub. in. (32-oz. C.A.) has the well-known long toggle mechanism exerting 350 tons clamp pressure. This new model retains the old features of the famous S.H.8/10 injection moulding machine such as, platen area 29″ x 25″ and the 25 h.p. motor drive, whilst giving a trebled capacity.

The 2044 AUTOPLAS again offers 44 cub. in. injection capacity, but has a large powerful toggle unit giving a 600 ton lock, and platen area of 38″ x 34″.

This machine, due to its efficient principle, requires only a 25 h.p. motor, and provides industry with a machine at half the horse-power normally required on equivalent conventional machines of this size.



Advantages these New Models Offer!

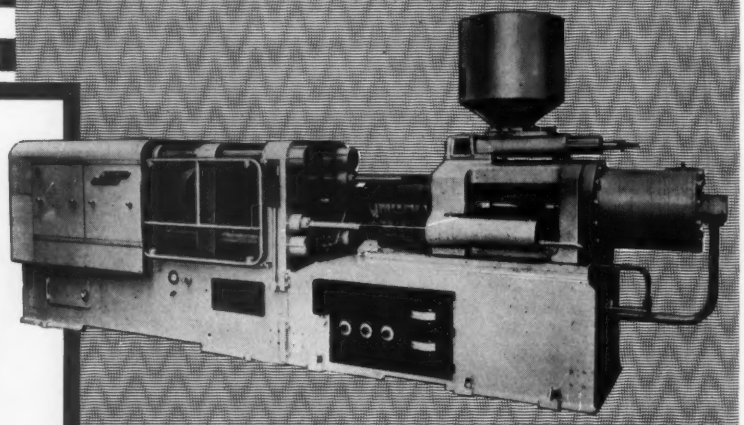
- *Complete cleanliness without a trace of bleed-back.*
- *Easier maintenance and cleaning.*
- *Easy colour and material change.*
- *Strain-free parts.*
- *Less part distortion.*
- *Lower injection and clamping pressures.*
- *Weight savings up to 10% in a great number of cases.*

Write to-day for Leaflet A109 giving full specifications

R. H. WINDSOR LTD. Leatherhead Road, South Chessington, Surbiton, Surrey, England
Phone: EPSOM 5631 (Private Branch Exch.) Grams & Cables: 'WINPLAS' SURBITON SURREY

facts

that speak for themselves



"SUNNYCAGE" BIRD CAGE

WEIGHT—500 grams each half of cage (the cage is moulded in two identical sections from one tool and chemically welded).
MATERIAL - Polystyrene
TIME - - 25 per hour
Moulding by EKCO Plastics Division for and to the design of "Sunnytoys" (Distributors) Ltd., of Blackpool.
Mould designed and made by EKCO Plastic Division.

The design and proved performance of PECO Injection Moulding Machines result in the production of plastic articles of the widest range, from simple domestic goods to intricate mouldings such as this Bird Cage illustrated. Always these machines give the same perfect, undeviating production flow. Do you ask for impartial recommendation? It comes from the manufacturers all over the world who have installed them.

Illustrated literature describing the full range of PECO machines will be sent on request.

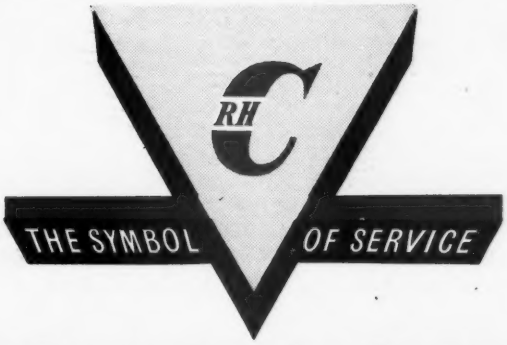
MOULDS

PECO MOULDS. Expert designers and mould makers are employed and moulds can be supplied to samples submitted, including die-sinking models if required. An important side of the Company's work is the hobbing of cavities for moulds and medallions—the plant includes a 3,000-ton hobbing plant. Master hobs to customers' samples made as required.

PECO PRODUCTS

The
PROJECTILE & ENGINEERING COMPANY LIMITED
ACRE STREET, BATTERSEA, LONDON, S.W.8, ENGLAND
Telephone: Macaulay 1212 Telegrams: "Profectus, Claproad, London" Cables: Profectus, London

R.H.C. PRODUCTS



A Most Comprehensive Range of Raw Materials for the Plastics Industry

As Specialists of long standing in raw materials for Plastics we feel the time has come to list briefly our range of products. The range, always comprehensive, has increased recently to a remarkable extent in pace with the latest technical developments.

STYRON 475 SHEETING	For forming by conventional methods.	**RHC POLYSTYRENE MOULDING GRANULES**	For injection and compression moulding and extrusion.
STYRON **666 General Purpose** **777 Medium Impact** **475 High Impact** **700 Heat Resistant** **637 Light Stabilised**	For injection and compression moulding and extrusion.	**ADHESIVES**	For Plastics.
		STYRENE MONOMER	Glass clear. light stable. Heat sensitive. For Polymerisation in the manufacture of plastics, laminating and sealing compounds, co-polymers, etc.
CELLULOSE ACETATE MOULDING POWDER	In a range of colours for injection moulding.	**CELLULOSE ACETATE FLAKE**	For the manufacture of moulding powders, lacquers, strippers, foils and sheeting.
METHYL METHACRYLATE POLYMERS & MONOMER	Glass clear, light stable inert. For surface coatings and dental purposes.	**POLYAMIDE MOULDING COMPOUNDS**	For injection and extrusion.
		POLYURETHANE MOULDING COMPOUNDS	For extrusion and injection for articles having high mechanical qualities.
VINYL CHLORIDE POLYMERS AND CO-POLYMERS	Compounds for calendering, injection and extrusion.	**ACETO BUTYRATE FOIL (ELECTRICAL INSULATING)**	For cable and wire wrapping. Insulating.
CELLULOSE ACETATE BUTYRATE MOULDING COMPOUNDS	Injection and extrusion.	**POLYESTER RESINS (COLD SETTING AND HEAT HARDENING TYPES)**	For impregnating glass fabrics, potted circuits, etc.
TRIFLUORO-MONO-CHLORO ETHYLENE (Fluorinated high Polymer Hydrocarbons)	Moulded goods. For high electrical properties, chemical resistance, etc.	**TOMLINITE LIGNIN POWDER**	Colour: dark brown. Reinforcing agent filler-extender for Phenolic resins, laminates, etc.
POLYALCOHOLS AND ISOCYANATES	Cross linked light density products. For expanded plastics acoustic and thermo-electrical applications.	**PHENOL FORMALDEHYDE THERMOSETTING RESINS**	For laminating, bonding and foundry work.
		THERMOCHROM CRAYONS (TEMPERATURE INDICATORS)	Temperature indicators for machinery heating systems, etc. Rapid and distinct colour change.
PHENOL FORMALDEHYDE & UREA FORMALDEHYDE THERMOSETTING MOULDING COMPOUNDS	For compression and transfer moulding.	**THERMOCOLOUR POWDERS**	Uses as above. Soluble in industrial methylated spirit.

TRADE GRINDING SERVICE. Complete modern equipment, particularly adapted for the requirements of the Plastics Industry. At your service, for all GRINDING, CRUSHING, PULVERISING and MAGNETIC SEPARATION.

In addition to our own manufacturing activities we are Concessionaires for sixteen manufacturers of highest repute at home and abroad, thus, in effect, all products are supplied by us at FIRST HAND.

R. H. COLE & COMPANY LTD

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Telephone: ABBey 3061 (10 lines) Telegrams: GERATOLE, PHONE, LONDON

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POLYSTYRENE MOULDING POWDER

MANUFACTURED BY BX PLASTICS LTD AT BRANTHAM WORKS MANNINGTREE ESSEX

Write for details to Moulding Powder Sales Department

BX PLASTICS LIMITED

HIGHAM STATION AVENUE LONDON E4 LARKSWOOD 5511

BCL

we should have done this before

They say "what you never have you don't miss" but once you break away from old out-of-date methods, you soon notice the difference. Since we've had these Bennis Stokers we have saved time, labour and fuel, and a lot of other headaches besides.

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MECHANICAL STOKERS

A COMPLETE COMBUSTION ENGINEERING SERVICE

Bennis are designers and manufacturers of a full range of Mechanical Stokers to suit most types of Boilers, and are, therefore, able to do what no other manufacturer in this Country can do, that is, install the correct machine to meet the conditions and requirements prevailing in each individual plant.

Write for illustrated Brochures describing :—

The Bennis Air Draught Sprinkler Stoker.
The Bennis Coking Stoker and
The Bennis Unit Travelling Chain Grate Stoker.

Write for literature to Dept. P/3

BENNIS COMBUSTION LTD., Little Hulton, Walkden, Manchester · London Office: 28, Victoria Street, Westminster, S.W.1

We are exhibiting at the FUEL EFFICIENCY IN INDUSTRY AND HOME EXHIBITION, NOV. 18-28, MANCHESTER CITY HALL.

P2970

F

Rover Car Factory, Solihull. High intensity lighting in a body spray tunnel by fluorescent lamps in a glazed enclosure.

Tailored for the job

The lighting of many processes is vital to the smooth and rapid flow of work and to the quality of the finished product. For example, poor lighting could make a spray tunnel into a bottle-neck — each job taking a little too long, a little portion missed, a return to the spray line — and so the whole production line marks time. Whatever form it takes, good lighting not only helps to provide a satisfactory working environment but is an active production tool.

Fluorescent lighting is as good as daylight — only more consistent. It is efficient; it is economical; and it is *flexible*. You can ' tailor ' it, easily and exactly, to the special requirements of production at all stages.

HOW TO GET MORE INFORMATION

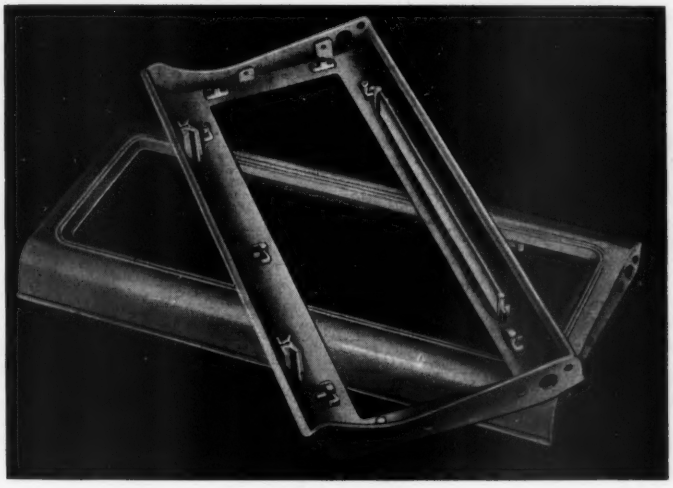
Your Electricity Board will be glad to advise you on how to use electricity to greater advantage — to save time, money, and materials. The new Electricity and Productivity series of books includes one on lighting — " Lighting in Industry ". Copies can be obtained, price 9/- post free, from E.D.A., 2 Savoy Hill, London, W.C.2, or from your Area Electricity Board.

Electricity for PRODUCTIVITY

Issued by the British Electrical Development Association

MOULDINGS . . .

THE REGENTONE "MULTI 99" Table Model Radiogram required a moulded escutcheon of exacting standards in Cream Polystyrene. Technical liason between customer and works ensures the maintenance of these limits, and the production of a moulding suited to this high-class set.



Tools and mouldings are produced in our own works by men with experience. Over 30 years' "know-how" is applied to your problems.

W. W. BALL & SONS LTD.

BURSTEAD WORKS • KENNEL LANE • BILLERICAY • ESSEX

PHONE: BILLERICAY 411/12 GRAMS: PLASTOOL, BILLERICAY

"There's a seal in this carriage, Mr Ash"

"A performing one, I suppose, Mr. Downs."

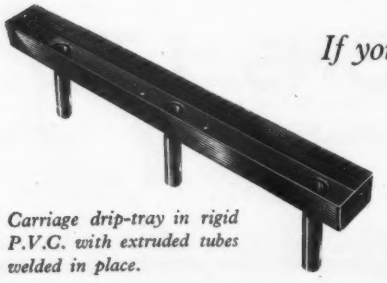
"No a watertight one, Mr. Ash. I refer to the carriage drip-tray fitted inside the carriage door — a costly and cumbersome item until we took over its manufacture."

"And now it's neat and cheap, Mr. Downs."

"Precisely. Moulded in P.V.C. (Polyvinylchloride to you!) with little extruded tubes to carry away the moisture, it's proof against even the English climate."

"Will it mean cheaper fares, Mr. Downs?"

"No, but it certainly means cheaper drip-trays, Mr. Ash!"



Carriage drip-tray in rigid P.V.C. with extruded tubes welded in place.

If you want to know what Plastics can do for you

ask Ashdowns

ASHDOWNS LIMITED, ECCLESTON WORKS, ST. HELENS, LANCS.
Phone: St. Helens 3206.

Ashdowns Limited is a subsidiary of Pilkington Brothers Ltd.

DISTEC

The finest FATTY ACIDS *for plasticisers*

CAPRYLIC ACID
A101
AVERAGE TESTS

Acid Value	385
Saponification Value	385
Mean Molecular weight of Fatty Acid	145·7
Unsaponifiable	Trace
Iodine Value	0·8
Titre	13° C.

AVERAGE COMPOSITION

Caprylic	90%
Caproic	3%
Capric	7%

CAPRYLIC CAPRIC ACID
A101/2
AVERAGE TESTS

Acid Value	330/340
Saponification Value	330/340
Mean Molecular weight of Fatty Acid	160/165
Unsaponifiable	1% max.
Iodine Value	1 max.
Flow Point	0/10° C.

AVERAGE COMPOSITION

Caproic	Trace
Caprylic	35-45%
Capric	30-35%
Lauric	20-25%

CAPRIC ACID
A102
AVERAGE TESTS

Acid Value	323·7
Saponification Value	323·7
Mean Molecular weight of Fatty Acid	173·3
Unsaponifiable	0·5%
Iodine Value	1·2
Titre	30° C.

AVERAGE COMPOSITION

Capric	90%
Lauric	7%
Caprylic	3%

LAURIC ACID
A103
AVERAGE TESTS

Acid Value	276 min.
Saponification Value	276
Mean Molecular weight of Fatty Acid	203
Unsaponifiable	0·5% max.
Iodine Value	1 max.
Titre	37·8° C.

AVERAGE COMPOSITION

Capric	Trace
Lauric	90%
Myristic	9%
Unsaturated Acids	1%

Mould Lubricants. Stearic Acid and Stearines in finely powdered form or flake and in various qualities are available in bulk.

We're glad to meet people with problems

How often we talk to people with *special* processes needing *special* fatty acids! And as many times, we're pleased to say, we are able to supply just the formulæ they require . . . specially made up if necessary. Let us call on you right away for a discussion of your *own* problem.

Write for fully descriptive Catalogue to:

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ELECTRIC Process Heating

FURNACES · INFRA RED · HIGH FREQUENCY

● Bold thinking about bigger production demands new methods of heat treatment. G.E.C. *electric* process heating ensures maximum output and true economy. The many heating equipments in its range are clean, safe, simple to operate and heat rapidly to constant, correct and controlled temperatures. Its versatility is being proved every day.

● It has unlimited applications : from glue-setting in a wood-working firm to bright brazing in heavy industry. For example, in the Plastics industry it is widely used for thermoplastic materials, thermosetting, gellation or fusing of plastic coated fabrics, and numerous other processes.

● G.E.C. has had many years' experience in the design and construction of heating plant. The Company's specialists welcome opportunities to discuss potential uses.

High Frequency Heating

G.E.C. PLASTIC PRE-HEATING GENERATOR

for uniform pre-heating of a mass of thermosetting plastic powder or preforms prior to pressing. Pressure moulding processes are speeded up and additional plasticity is given to the charge. This advantage is even greater where the thickness of the charge increases. Up to 1½ lbs. of plastic can be dealt with per minute, depending upon the temperature to which the material is to be preheated. G.E.C. has produced a range of high frequency power generators.

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

ETHYLENE GLYCOL
DIETHYLENE GLYCOL

Ethylene glycol, grade S, a plasticiser for transparent cellulose film; solvent for basic dyestuffs; intermediate in the production of alkyd resins, polyesters and other ethers and esters.

Diethylene glycol, a plasticiser; solvent for dyestuffs, gums and resins; intermediate for solvent ethers and esters.

FURFURYL ALCOHOL

Furfuryl alcohol derived resins have outstanding resistance to acids, alkalis, and solvents. Alone and in combination with other resin formers they are recommended for the manufacture of chemical-resistant industrial materials.

Also available: ACETONE, NONANOL, 'ALPHANOL' 79.

INFORMATION FROM
IMPERIAL CHEMICAL INDUSTRIES LIMITED
LONDON, S.W.1.
B.730

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FIRST CHOICE!

● FOR BETTER MOULDINGS
● FASTER PRODUCTION
● EASIER OPERATION

- Robust one-piece welded steel box-type frame prevents distortion under locking pressure.
- Die locking is by hydraulic operated rapid-acting double-toggle linkage with 112-ton die pre-load.
- Die height adjusted by single central screw giving micro-meter accuracy.
- Mechanical cut-off to vertical injection cylinder permits moulding of fluid materials such as nylon.
- Three separate heating zones and individual temperature controls give unsurpassed plasticizing.

The British Built

LESTER

MODEL L-½-4

INJECTION MOULDING MACHINE

4-OZ. CAPACITY

Rated in Polystyrene

DOWDING & DOLL LTD
TELEPHONE : TATE GALLERY 9431 (10 LINES)

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TELEGRAMS: ACCURATOOL · SOWEST LONDON

TOYS CAN BE DANGEROUS!

There's no fear of jagged edges with 'Celanese' Acetate Flake!

If you are a manufacturer, ask the moulding powder producer for powders made from 'Celanese' Acetate Flake. Acetate means fewer breakages in production and in transit; it means better, **safer** toys. If you are a retailer, ask your supplier for toys made from Acetate. Safety is always a sure seller and Acetate is shatterproof, splinterproof and tough—tough enough to make selling easy. Play **safe** with Acetate!

Make sure your toys are made from

'Celanese' Acetate Flake

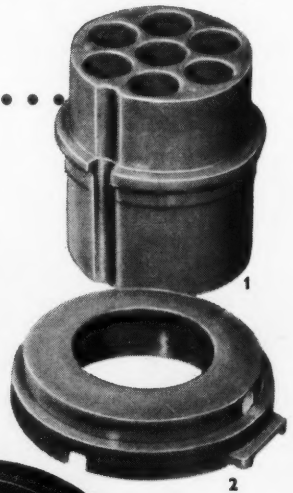
They're safer, tougher and more hygienic

BRITISH CELANESE LIMITED, Celanese House, Hanover Square, London, W.1.

NOW AVAILABLE

Alkyd Moulding Materials

Once again a BAKELITE development opens up new moulding possibilities. The alkyds offer a number of important properties, including electrical insulation in wet or dry conditions, exceptional resistance to tracking, dimensional stability up to very high temperatures in wet or dry heat, and good water resistance. An outstanding feature of these new materials is that they can be moulded on standard compression equipment. Normal temperatures and pressures only are necessary, and they have approximately the same curing time as ordinary phenolic materials.



The properties of BAKELITE Alkyd Materials make them suitable for many electrical applications. Illustrated above are (1) an H.T. socket for aircraft magnetos, (2) a bulb holder sleeve, (3, 4 and 5) parts for toroidal potentiometers moulded by L. G. G. Charlesworth & Co. for P. X. Fox Ltd. of Horsforth, Yorkshire.

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Plastics

DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS

PROPRIETORS: TEMPLE PRESS LIMITED

CHAIRMAN and MANAGING DIRECTOR: ROLAND E. DANGERFIELD

EDITOR: M. D. CURWEN, B.Sc., A.R.I.C.
ASSISTANT EDITOR: C. W. WELCH

An operator prepares his charge for a 1,200-ton press at the Witton Moulded Insulation Works of the General Electric Company, Ltd.

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NP 1

all these plastics mouldings for the new Standard '8' car

Last but by no means least of this new range of plastics mouldings are the speedometer drive gears which we mould from Nylon. Practical applications of the hard wearing qualities of moulded Nylon are still few; that it has been chosen by the Standard Motor Company for service in their newest model is proof that Nylon—expertly moulded—is coming into its own.

The other parts illustrated here are made from phenolic moulding material.

All the moulds were designed and made at our Walthamstow factory.

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Plastics

VOL. XVIII. No. 196 NOVEMBER, 1953

EDITORIALS

Problem of Scrap

OUR August, 1953, issue contained an editorial dealing with the problem of thermoplastic scrap from the injection moulding machine. Its main theme was the almost complete ignorance that exists in the moulding shops in this country and abroad, on the degrees of degradation that occur in various plastics that are used. So far as our searches go, the scientific and technical literature is far from helpful and neither raw material makers nor injection-machine builders offer the moulder any advice other than in very vague terms which leave the said moulder to his own devices. We seem to have made little or no progress in the 20 years or more of the injection moulding process, in a subject which from the costing point of view (quite apart from the probably more important aspect of quality) must affect the moulder profoundly. The whole matter appears to us far more important than all the rivers of highfalutin lip-service that have flowed and have been paid to the sublime destiny of plastics of which most speakers and writers, including ourselves, have been guilty. It seems strange that no voice other than our querulous own has been raised to suggest that this is a practical problem worthy of examination. That it is, is confirmed by the few letters we published in our September issue and by the promise of a well-known British scientist and plastics technologist now working in America that he would take up the problem. Today, in the form of a letter, comes added confirmation from Mr. J. S. Walker, technical director of Fraser and Glass, Ltd., who was an important member of the Productivity Team that visited the U.S.A. in 1951. We publish this letter on page 387 without further comment, except to indicate that it pin-points more precisely than any other the different degrees of degradation in the same material under changing conditions and our lack of knowledge of degradation itself.

Much pure physical research work is being carried out on the behaviour of plastics and more recently the publication of work nearer our present subject, carried out by researchers at Monsanto's laboratories at Fulmer Hall, shows how important and how apposite to our future knowledge of these non-Newtonian fluids this fundamental research is. But surely there is also room for *ad hoc* technical research on degradation based on the effect of continued recycling on mechanical and electrical strengths and other properties; the testing apparatus is all available in dozens of works. All that seems to be lacking is time and the attitude to consider the matter of sufficient importance.

The World and Plastics

THE plastics industry has for some years been fortunate in the manner in which a few of the great daily papers have dealt with the broad developments in our field. *The Times*, for example, in its regular industrial supplements and by the pen of Dr. Yarsley, has dealt with various aspects of importance, generally purely technical, in a balanced and accurate form such as we expect from that paper and from its correspondent who is so well known and honoured in our industry. We have no doubt whatsoever that this technical journalism, written simply and clearly, is read not only by technologists but also by a wide circle of industrialists and other readers with considerable benefit to themselves.

With the more rapid growth and increasing stature of the plastics industry it has been also pleasing to see the obvious interest of *The Financial Times* in our activities, noting more than others the economic structure, good health or malaise as and when they occur with understanding. Obviously such notes and articles have occupied but little space generally and have occupied no "important" position in the general make-up; indeed we have been content with that, since compared with the great traditional industries, plastics manufacture and its activities must to the great financiers of the world have seemed and probably still does seem small beer.

October 6, 1953, therefore, will always stand out in our minds as being a very special day, for it was then, on its front page, and in the "most important" position on that front page that *The Financial Times* published an almost complete double column—carefully, accurately and understandingly—under the title "Marked Recovery in Plastics." It will stand out in our minds not so much because of our pleasure in our industry's recovery (we and some of our readers have noted the gradual improvement during the past eight months while some workers have noted none), but simply because the news appeared as "front page news" in one of our leading newspapers in an accurately analytical form; it means, as no other piece of "plastics" news has ever meant, that our materials have assumed at long last in the minds of thinking people, the position of materials of construction which can be considered *vis-à-vis* those of tradition and which the discerning may employ or not, according to the job.

October 6 was of course of no real special significance in the life of *The Financial Times*. Nor, immediately after, did demand by the public for our products leap up; nor did the output of the factories and profits increase immediately thereafter. But we shall always be grateful for a lead in healthy journalism that is important to our own well-being and that will, we hope, be followed by others.

Of course, accurate journalism has not always been general; in the bad old days, some daily papers, bemused or fascinated by the "white coated wizards of chemistry" who presumably had discovered the Elixir of Life and the Touchstone that transmutes base metal to gold, boldly declared, by inference, that we had now entered the era where everything from ships to shoes and sealing wax and synthetic cabbages and possibly ready-made Kings, could be had for next to nothing since they were all made from coal (at £5 a ton), from sea-water which only wanted pumping from the sea and from the air which all of us know is even cheaper than that.

When such dailies delved into the technicalities of plastics, on receipt of odd snippets of information, their conclusions were sometimes, to say the least of it, insufficiently close to the facts. We well remember when one famous company had changed over, in the manufacture of polythene, to using ethylene made from petroleum, discarding ethylene made from alcohol (produced from imported molasses) and had considerably increased its ethylene production for use also in making other products, one daily paper issued the statement that thereby polythene production had been increased three times

overnight. It had already calculated the immense profits that had thus been made by this miracle invention! Obviously production had not increased by one ounce; indeed we would surmise that the factory had closed down because a sensitive valve had burst on hearing the news! It needs little technical knowledge of the polythene process to realize that because of the painfully slow production of the high pressure bombs of special steel, because of the care with which the delicate control instruments must be made, because the slow and careful training of scientific personnel cannot be hurried and because of the great finance required and many other reasons, the time for doubling a plant can only be measured in years.

During the past year several important facts have helped plastics on the road to public "recognition." Polyvinyl chloride conveyor belting for mines, clothing for the Navy and polythene tubing for agriculture and housing are standardized, the Minister of Supply has spoken of the importance of special plastics for guided missiles, empty polythene bottles are sold in almost every druggist's shop, a new "all plastic" school in Edinburgh is being built and the Motor Show has exhibited a number of "plastic" cars. We are indeed "on the industrial map."

MOULDING POWDER AND SHOT

I was delighted to receive a number of inquiries for further details of the polythene cage for drying lettuce that I picked up in Nice a month ago and reproduced in a photograph in our October issue. Another company has designed a very similar one and hopes to put it on the market here. Yet another from Smith Bros. (who address their letter as it should be addressed!) adopts a completely different method to obtain eminently successful results. I reproduce their letter and photograph herewith.

Salad Washing Basket

Dear Dogsboddy,

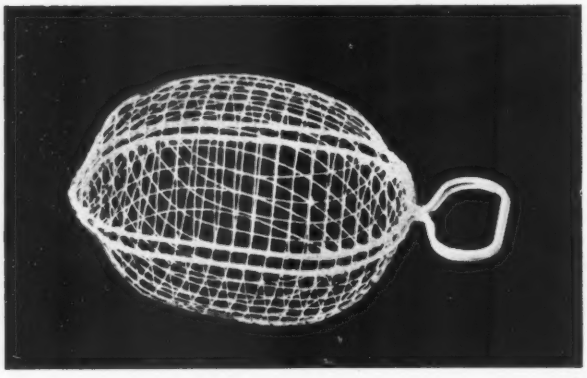
We have read with interest the article regarding salad washing baskets which appears in the October issue of *Plastics*. We have been manufacturing a tinned salad washing basket for many years and cannot agree that they are particularly fragile, and must stress that with our special method of tin coating they are remarkably rust resistant.

We have for some three years, however, been marketing a range of plastic cushioned housewares, including dish drainers and bathroom equipment and some twelve months ago we added to this range a plastic cushioned salad washing basket. This has many advantages over the injection moulded pattern referred to in your article as, being steel cored, it is so much stronger.

The plastic cushioned salad washing basket is available from most of the leading stores in this country, but until recently the bulk of our output had been exported. We enclose a photograph.

Yours faithfully,
for Smith Bros. (Wirewares), Ltd.
P. WINTER.

Birmingham, 11.



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Now and again I see a French picture paper called *Noir et Blanc* (a very clever title, too, when you come to think of it). One of the recent issues contains an amusing and apparently true story from Central Africa of children's rattles of the spherical plus "orbital" type made in France from polystyrene. Some of them suddenly gave birth to a stalk and pretty little leaves which shot out from the small holes made in the spheres. It appears that some of the balls or cubes which provide the rattling noise had been replaced on an occasion of shortage by haricot beans, and what with the humidity and heat. . . . Well, this may be a "stretcher" as Huck Finn used to say, but it raises interesting possibilities in instructive toys if one could guarantee the germinating of the bean!

Jack and the Beanstalk

◆ ◆ ◆

The Radio Exhibition was significant, as was noted last month in this journal, for the "austerity" of design of radio and television cabinets. I suppose we can call this a trend to functionality in design. I hope this to be a fact and that the days when the salesman "put across" to the hypnotized rabbit of a buyer that what he or she really needed was a lovely bit of furniture, have gone. I will be hanged as high as Haman for this, but I hope it will be the end of the craftsman carpenter employed in producing fantastic anachronisms by aping Sheraton and Hepplewhite or even Greek architecture for what should be a 20.5th century simple apparatus for producing agreeable sound or pictures. If added beauty is wanted for attracting customers much can be done with the escutcheon (what a strange word to use for a frame!) or, as the French do, by producing jewel-like controls from moulded polystyrene. Paris is full of lovely examples. In one of H. Annesley Vacheil's "diaries," his friend the Colonel "whipped me off the premises" for hinting that the designer and producer in plastics (that is, of mass productions) can also be a craftsman. I hope the Colonel is still alive and whipping, for I am sure he would agree with me about the foregoing stupidity.

Functionality

◆ ◆ ◆

I shall get very few cheers from schoolboys, I'm afraid, for the suggestion I sent the Minister of Education last week, that much of the taxpayers' money would be saved if all canes were covered with extruded p.v.c., since it would prevent their fraying and they would last indefinitely. Let me whisper in the undoubtedly receptive ear and, I note with sadness, the still undoubtedly dirty ear of Gubbins Minimus, that it is really only a trick. The formula for the extruded p.v.c. which I have patented at great expense and forwarded to the Minister, really contains 30 per cent. of plasticizer, so that a swishing will inflict far less damage than formerly. I have also inserted a special spring which will cause the said cane to rebound and hit the executioner on the nose. It will not bring me much money, I suppose—but it's all in a good cause—especially, as the Editor reminds me, we are publishing in December an almost entire issue on the art and/or science of extrusion of plastic materials. The Editor would be grateful to receive from all manufacturers of raw materials, of extruding machinery and of all ancillary devices, motive power, take-off and winding machinery, control instruments, of new and extruded forms, any details of their products which would prove useful to the issue.

Painless Extrusion

DOGSBODDY.

The Motor Show Reviewed

A number of new applications of plastics materials was seen at the Motor Show held in London last month. These included the first British plastics-bodied car designed for production and another car incorporating a number of panels in the body made from laminated plastics by a new process. New plastics components and products were also seen in the Boats and Caravans sections of the Show.

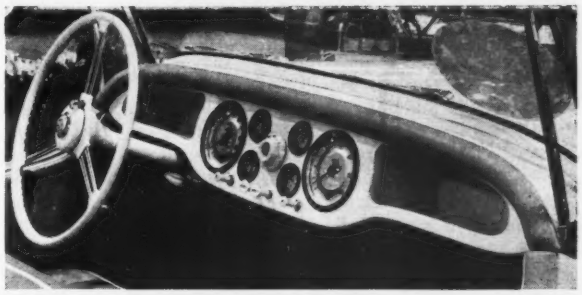
HAVING seen a number of experimental and hand-made cars produced from glass fibre reinforced plastics during recent months, it was expected that motorcar manufacturers would show some commercial applications of the new techniques at Earls Court this year. Visitors to the Motor Show were not disappointed in this respect since a number of new models make extensive use of reinforced plastics.

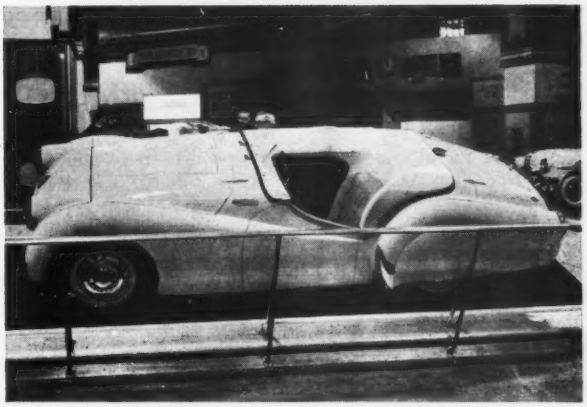
The Singer SMX four-seater roadster is the first British car to be designed for production with a plastics body. Mounted on chassis employed for previous Singer roadsters, the body is constructed entirely of polyester resin reinforced by glass fibre mat. The body shell consists of only five sections. The front section, which incorporates bonnet, wheel arches, etc., is moulded in one piece and, being hinged to the front cross-member, can be swung open, providing unrestricted access to the engine unit. The other main body sections are the scuttle carrying the windscreen, the doors and the rear section, which comprises the rear unit of the car. Also moulded in the same material are the wheel arches, the one-piece instrument panel and glove box, the spare wheel cover and the petrol-filler door. The advantages claimed for the plastic body are light weight for the same strength as metal (the body is said to be little more than half the weight of Duralumin), resistance to impact, and ease of repair if serious damage does occur. The car has been designed exclusively for the export market and when first announced Singer Motors, Ltd., did not state the price and could make no estimate as to likely production quantities.

Another new sports car first unveiled at Earls Court is the Jowett R.4 Jupiter, in which considerable use of laminated plastics has been made in the construction. The manufacturers state that there is no reason why the body shell of this car should not be made entirely of plastics when serious production is started. The car shown, however, makes use of a percentage of steel panelling. The body parts have been produced by Jowett Cars, Ltd., using the Automold process developed by Automold Plastics, Ltd., 32 St. James's Street, London, S.W.1.

This process is one by which pre-treated fabrics may be readily laminated without the application of heat or pressure.

The pre-treated fabric possesses a good self life and is uniformly loaded. This, together with the fact that the mixing of various chemicals and the handling of sticky, viscous solutions by the moulder is eliminated, facilitates standardization of finished results. The process is one of true lamination and the curing period, from the time of commencing "lay-up,"





Plastics at the Motor Show—top to bottom: Singer SMX roadster with plastic body; plastics facia for the Singer; Triumph speed model with plastics tonneau cover; Jowett R.4 Jupiter with panels made by Automold process.

(Left) The boot-lid of the Jensen 541 sports saloon is the first part of this car to be made of glass fibre laminates. A complete plastic body is in preparation.

(Right) The R.E.A.C. plastic-bodied car shown at the Paris Motor Show incorporates several unusual design features.

is comparatively short. Physical properties depend on the nature of the fabric used, and comparatively high tensile and impact strengths can be achieved.

The same reasons are given by Jowett Cars, Ltd., for adopting the use of plastics for bodywork, i.e. strength, lightness (25% has been saved on the body-shell weight compared with the previous model), lower cost and the ease of making necessary repairs. The principal feature of the whole design is the high power-to-weight ratio, giving the R.4 excellent performance figures, with maximum speed over 100 m.p.h.

Although these two cars represent the most extensive progress made by British car manufacturers to date, a number of other exhibits indicate the serious interest of the whole motor industry. Undoubtedly one of the most attractive features of the plastics body, particularly in this country where comparatively small runs of high-performance cars are produced, is the high speed and low cost of making changes in design. With pressed-steel body parts tooling may take months to complete and involve enormous costs in materials and skilled labour. The simple tools required for plastics low-pressure laminates are much cheaper and a drawing-board concept may be turned into reality in a matter of weeks.

The full benefits of lower production costs will, however, not be obtained until designers and manufacturers have realized the flexibility of design which can be achieved with the laminating techniques now being evolved.

Jensen Motors, Ltd., who showed two models, including their new "541" saloon, are actively working on the construction of an all-plastic body. Both Show models were fitted with boot-lids made of glass fibre reinforced resins. Here, as with the other models described, the surface finish was exceptionally good, metal and plastic parts being indistinguishable to the eye.

Standard Motor Co., Ltd., have solved a special problem of car construction with plastics. For maximum performance of the high-speed version of the Triumph sports car, the two-seater is converted into a single-seater by means of a tonneau cover fitted over the cockpit. This cover has been made from glass cloth resin laminates by Marston Excelsior, Ltd.

Various other manufacturers and bodybuilders are examining and developing the potential application of reinforced plastics to motorcar construction. It is interesting to note that not one of the many U.S. manufacturers represented at Earls Court showed a car with plastic body despite reports earlier this year that full-scale production was starting on two U.S. plastic sports cars. At the Paris Motor Show earlier in October the first French car with plastic body was revealed. The R.E.A.C. has several unorthodox features, including the doors which are hinged on the roof and swing upwards.

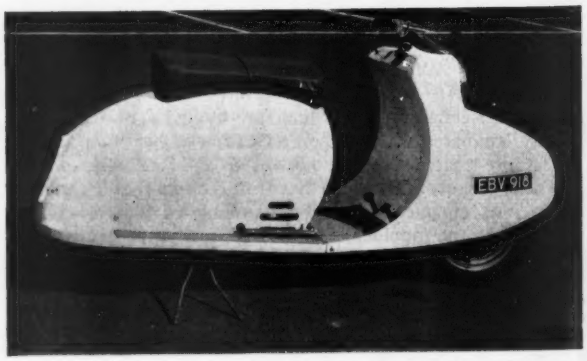
The structural use of plastics laminate has naturally dominated news of the Motor Show so that progress in the more conventional uses of plastics in cars has received little attention. Moulded components are competing successfully in the small car field with equivalent metal components; for example, the beautifully moulded instrument housing for the Standard Eight. P.V.C. extrusions are being used as wing piping and oil-resistant p.v.c. cables for electrical systems.

In seating upholstery p.v.c.-coated leathercloth has been gaining popularity amongst users for hard-wearing and easy-cleaning properties and with manufacturers because of lower cost and less labour required for fitting. Tygan, woven polyvinylidene chloride filament, so far used mainly for loose covers, is now specified as the upholstery material for the Standard Eight.

In the Caravan section, plastics, and particularly fabrications, are employed for their light weight in applications such as sinks, roof lights, etc., but so far it has proved too costly to use plastics structurally. Of particular interest at the Show was a new roof-covering material developed by Willerby Caravan Co., Ltd., Hull. This is a glass fabric, coated on both sides with p.v.c. to give a strong, weather-resisting material.

In the Motor Boat section, Boats and Engines, Ltd., and W. and J. Tod, Ltd., showed their glass-fibre reinforced plastics boats, and in addition Wright and Sons (Ipswich), Ltd., showed a new 8-ft. 3-in. boat of the same material.

Previewing a Motor Cycle Show exhibit *Motor Cycling* of October 22 gave details of the "Oscar" motor scooter produced by Projects and Developments, Ltd., Blackburn. The most revolutionary feature of this scooter is the fact that the motor and all other parts of the mechanism are fully enclosed by a neatly designed body constructed of glass-fibre reinforced plastics.



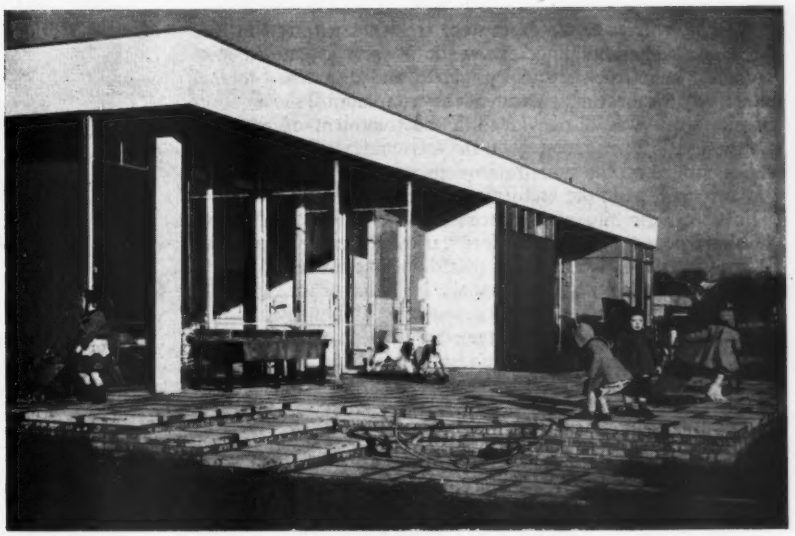
"Oscar" motor scooter with plastic body.

Plastics in Prefabricated Buildings

By

J. B. SINGER,
B.Sc.(Arch.), A.R.I.B.A.

Notes on some new developments in the use of plastics in the building industry.



Beechwood Day Nursery, Garston, Herts.

ALTHOUGH the manufacture of prefabricated buildings has passed its post-war boom, it is generally recognized that constructions of this type are not a transitory phase in the building industry. Prefabricated components have proved their value and have come to stay side by side with traditional materials. While many existing types have been improved, new developments have also taken place and their practical possibilities tested under actual conditions.

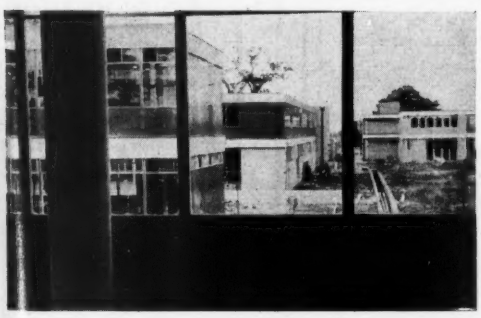
Among other materials, plastics have played their part in the progress of prefabricated buildings. Various types of plastics, including high pressure laminates, honeycomb core panels, resin-bonded glass fibres and resin-bonded asbestos laminates have been used for prefabricated building components.

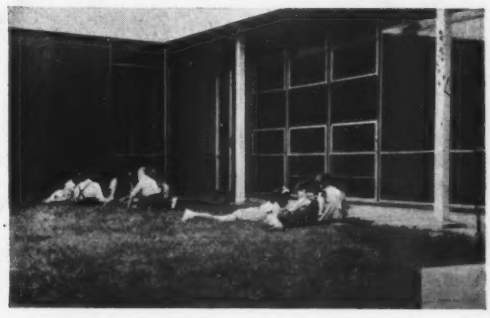
The prototype block at the Clarendon Secondary School at Oxhey, Herts. (described in the February, 1951, issue of *Plastics*) has been followed by several other buildings in which the external walls and internal partitions have been built up of "Holoplast" ribbed laminates (Holoplast, Ltd.); a three-storey block and other blocks forming part of the Oxhey School, Boreham Wood Primary School, Garston Day Nursery, I.C.I. Laboratories at Welwyn Garden City, all in Hertfordshire, and the Workshops at the Folkestone Technical College, Kent, have all "Holoplast" walls and partitions. The system of construction employed in these later examples differed from that of the prototype, and several refinements in constructional details were introduced.

All the above mentioned Hertfordshire schools were planned on the basis of a 3-ft. 4-in. grid, but while, at the Oxhey prototype, cruciform stanchions were used, in the subsequent buildings the steel framework was carried out on "mushroom" caps, 3 ft. 4 in. square, which were fixed centrally over welded hollow-box stanchions. Again referring to the Oxhey prototype, both the stanchions and the beams were offset by 20 in. from the Holoplast wall panels, but at Boreham Wood, Garston and Oxhey-stage 2, only the stanchions were offset. In both cases, the offsetting enabled the panels to maintain a constant width of 3-ft. 4-in grid dimension. In the prototype building, however, timber bridging pieces had to be fixed to provide a support for internal partitions at the ceiling level due to a gap between the partitions and beams, while in the later buildings, the "mushroom" cap allowed the beams to be on the grid line of the wall panels and thus support them directly.

The method of jointing the wall panels has also been greatly improved; formerly, the panels were 1-in. thick and spanned between aluminium alloy extruded sections. These sections were very prominent on the external face of the wall, and their thickness gave strong emphasis to the joint. Moreover, the panels were assembled together in a consecutive order and could not be erected as independent units. The new panels were $1\frac{5}{8}$-in. thick, and an ingenious type of extruded aluminium alloy sections, combined with Holoplast cover strips, was employed. These sections for two-, three- or four-way connections, with top and bottom fixing plates and angle cleats, were screwed down to timber strips at the floor level. The timber strips, which were pressure-impregnated, were inserted into a specially grooved slate sill, laid along the perimeter of the building. The fixing of the panels in position was done by means of a $\frac{3}{8}$-in. bolt in the top corner, a screw in the bottom corner between each panel, and angle brackets on each side of the frame. The cover strips with spring steel clips at 10-in centres were then fixed in position.

The erection of internal partitions was similar in principle, with the exception of the bottom fixture, which was in the form of a floor plate secured with Rawlplugs to the cement





(Left) Clarendon Secondary School, Oxhey, Herts.

(Right) Boreham Wood School, Herts.

(C. H. Caslin, County Architect.)

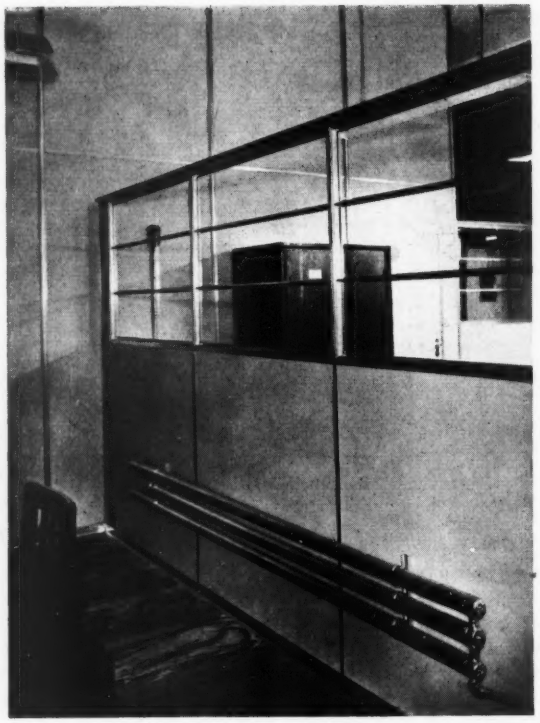
screed, after the floor finish had been laid. Unlike the Oxhey prototype, where the windows were erected separately on the site, in the later buildings the windows were assembled into complete panels in the factory, glazed and dispatched to the site, ready for erection. This tendency to minimize the amount of site work was also evident in the treatment of external finishes; a brown integral finish was preferred to a paint finish applied on the site. Internal panels were also brown, or stove enamelled in the factory; only some special panels were painted on the site with a primer, one undercoat and one finishing coat to provide a more varied colour scheme. All these wall panels were standardized into seventeen different (8 ft. by 3 ft. 4 in.) types of panels, including solid, fully and partially glazed panels, doors, heating grill units, etc.

In all the above examples, the ribs of the laminate showed slightly on the surface skin and delicate lines were visible when light was reflected from the surface. The vertical lines of the ribs and the thin strips of aluminium dividing the panels imparted an interesting texture to the wall.

Holoplast off-cuts were used effectively for W.C. and store partitions. These 8-in. strips from the standard panels were jointed by wooden inserts and then glued together. An interesting use of these strips was made in forming a curved wall to the library in the main block at the Oxhey Secondary School; instead of a single panel, five 8-in. strips were jointed together between aluminium alloy members, fixed to the floor and ceiling, and stiffened by top and bottom timber frames. Seven such sectional panels formed the curved wall. A further economy in the use of the material was obtained by employing 1-ft.-wide offcuts and building them horizontally into standard 8-ft.-high panels. The edges of the strips were bevelled to form a Vee joint, and thus a secondary pattern of horizontal lines was introduced to the strong vertical division of aluminium alloy jointing sections.

The method of fixing Holoplast panels in the workshops of Folkestone Technical College was somewhat similar to that of other schools; aluminium alloy extrusions were run the full height of the wall to support the $1\frac{5}{8}$-in. Holoplast panels and windows. A wide, $\frac{1}{4}$-in.-thick laminate was screwed to timber battens at the roof level to form a facia.

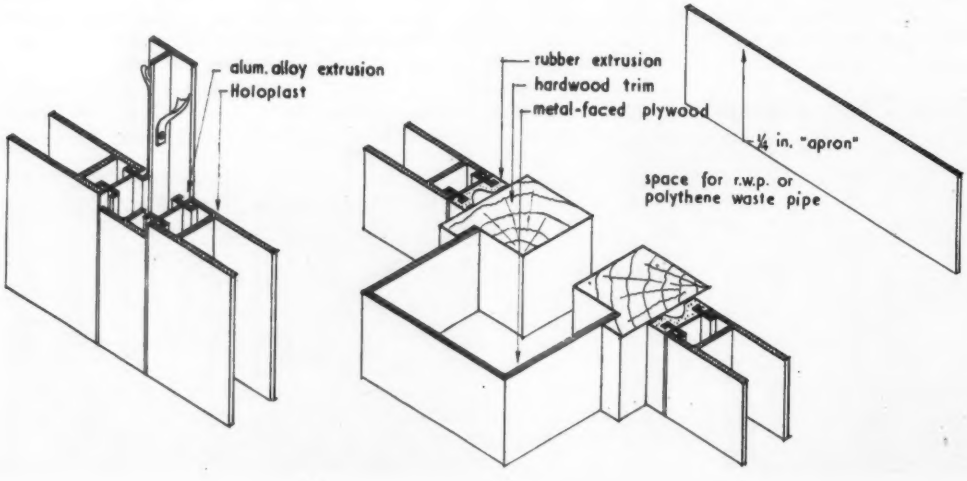
In the I.C.I. Laboratories, a totally different system of construction was adopted. Vertical steel members, i.e., structural mullions, were designed at 8-ft. centres and cased in metal-faced plywood. Since the maximum width of Holoplast panels was 4 ft., intermediate "service" mullions were constructed from two hardwood trims to provide vertical supports to the panels and to accommodate rain-water pipes, polythene wastes and other services. They extended the full height of the building and were covered with metal-faced



Interior decorated with Holoplast, by Firmin and Collins, Ltd., Northfleet, Kent.

plywood to match the structural mullions. Holoplast panels were cut in width so as to fit between the mullions and were filled with glass-fibre insulation. The panels were fixed by hooking to structural steelwork and the joint between hardwood trims was sealed with rubber extrusions. An apron of $\frac{1}{4}$-in.-thick sheet plastics was secured between the sill and the floor to conceal service pipes and wastes. The method of fixing of the panels was designed to allow for demounting and refixing from the outside of the building, when access to service pipes was required.

Other sheet plastics used in the schools were Corroplast and $\frac{1}{4}$-in. laminates. Corroplast (Holoplast, Ltd.) is a laminate of phenolic resin-impregnated kraft paper, compressed under high pressure into a corrugated sheet. It was chosen as a light roofing material for bicycle sheds, owing to



Typical Holoplast assembly details (left) for schools, showing cover strips with spring steel clips, and (right) for laboratories, showing "service" mullions.

its superior appearance over other corrugated sheets, such as asbestos-cement and iron. Corroplast roofing sheets were supported on timber wall plates, which rested on brick walls. They had a normal overlap at the joint and a zinc flashing, where adjacent to the brick wall.

Other minor uses of plastics in these schools included a provision of $\frac{1}{4}$-in.-thick panel sheets in metal doors, in place of plate glass. These sheets were employed in some bottom panels of doors and other positions, where glass was liable to break. They were placed between glazing beads, which secured them firmly in position and covered any irregularity of the edging.

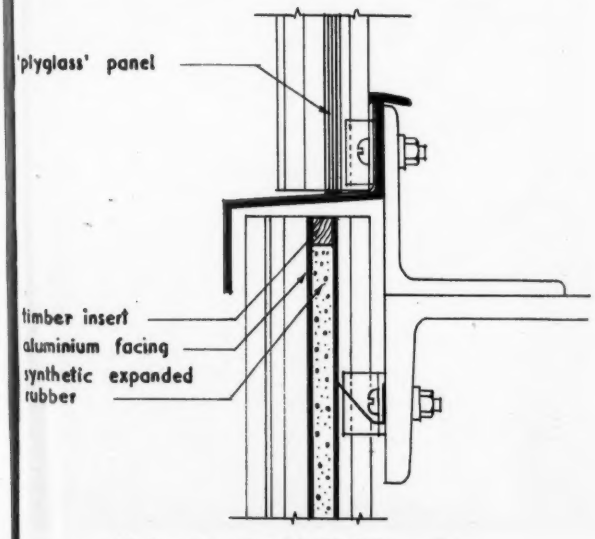
Resin-bonded Asbestos Panels

In the Handicraft block of the school at Oxhey, special panels were built up with resin-bonded asbestos boards. The board, under the trade name of Pluto (The Cape Asbestos Co., Ltd.) was impregnated with thermo-setting synthetic resins. It was manufactured in sizes of 8 ft. by 4 ft. in standard thicknesses of 2 mm. or $\frac{1}{8}$ in. (unlaminated) and $\frac{3}{16}$ in. and $\frac{1}{4}$ in. (laminated). The board has already been used for many applications, including concrete shuttering, fireproof doors, balcony panels, etc. In this building, a $\frac{3}{16}$-in.-thick Pluto board was screwed to a 3-in. by $\frac{3}{4}$-in. wooden frame with a $\frac{1}{4}$-in. hardboard backing. The resin-bonded asbestos board was bedded in mastic and painted.

Resin-bonded Glass-fibre Panels

A new type of wall cladding, which combines solid panels with translucent panels, has been used at the Coryton Oil Refinery building, Essex. Up to the level of 6 ft., the external wall is built up of brick and above this level (approx. 22 ft. high) it is built up of an aluminium framework with Plyglass and Jicwood infilling panels. Plyglass (Plyglass, Ltd.) is a translucent laminate which consists of two outer leaves of ordinary glass with a resin-bonded glass-fibre core. The core is sealed between the outer sheets of polished glass. The glass-fibre interlayer allows a 60% light transmission, reduces solar heat penetration and has a U value of 0.07. Jicwood panels, which are also used for lining bus roofs, are built up of $\frac{3}{8}$-in.-thick expanded synthetic rubber, faced with two stressed-skin aluminium sheets. These panels have a good thermal insulation and reduce the risk of condensation to a minimum. A solid timber fillet is inserted at the edges and the panel fixed, as shown.

An interesting variation of a glass sheet—glass fibre laminate is a new product, Vitroslab, also produced by Plyglass Ltd.



Wall panel at Coryton Oil Refinery, Essex.

Vitroslab consists of a sheet of glass, pigmented resin-bonded glass fibre and resin-bonded chipboard, hardboard or any other suitable backing. It is available in a wide range of colours; as a wall cladding, it offers interesting decorative possibilities for elevational treatments. It is essential that the glass fibre interlayer be effectively sealed and the framing section suitably designed, both to prevent the penetration of streaks of dirt-carrying moisture behind the glass, which could mar the appearance of the panel. The insulating property of the walling can be varied and depends on the nature of the backing material.

Another development, which appears to have some potentialities, is the combination of a very thin p.v.c. sheet veneered onto a solid backing, such as chipboard, plasterboard or asbestos. A pigmented p.v.c. facing should provide a weather-protective surface and a permanent colour finish. The bonding of such dissimilar materials and the effect of their dimensional movements due to temperature and moisture changes still have to be investigated.

Prefabricated Houses

Although several experimental houses have been built with plastics panels, a large-scale production of these houses has not followed. This was mainly due to the fact that the cost of these panels, which is an overriding factor in a small type of structure, such as a house, was too high. The principle of combining a suitable and cheap facing material with a lightweight core of plastics has often been advocated as a means of producing a satisfactory wall panel. A panel of this type, with two sheets of asbestos-cement and a Dufaylite core (Dufay-Chromex Ltd.), has been developed for Overseer bungalows, which are produced for export by Unit Construction, Ltd. Dufaylite is a resin-treated paper honeycomb core, designed as a basis of a low-density laminate. It was originally used for schools with a sheet of resin-bonded wood pulp and asbestos on the outside and a sheet of hardboard on the inside (*Plastics*, April, 1950). A similar panel was produced in France with two sheets of resin-treated plywood or plasterboard (*Plastics*, April, 1952).

The Overseer bungalow is built up of a series of timber framed portals with a "stressed-skin" of plywood. The Dufaylite core, $1\frac{1}{2}$-in. thick, is filled with exfoliated vermiculite to improve its insulation value, and bonded to the asbestos-cement facing sheets. For internal purposes, partitions are constructed in a similar manner, but are faced instead with plaster boards.

Glazing

The application of polyester resin-bonded glass fibres for glazing of houses is not a new one; $\frac{1}{16}$-in. sheets have been used for glazing a house built some years ago at Danville, California. This house is of interest, because the walls and the roof were constructed of timber-framed panels with two sheets of resin-bonded asbestos on either side. The glazing was in both flat and corrugated forms and in different colours; the clerestory windows had maze-coloured glazing and the entrance patio a rose-tinted translucent covering. Two pipes, manufactured from the same resin-bonded glass fibre material ran along the axis of the house in a duct under the floor slab and carried warm and cool air.

In other apartment houses, also built in California, translucent panels were employed in conjunction with a welded steel frame; walls, internal screens, balcony fronts and lay-lights were all built up of these panels. The panels were held in position by means of extruded aluminium alloy sections and rimmed with a special tape to ensure a water-tight joint. A continuous translucent surface was obtained by jointing sheets with a translucent mastic.

Several manufacturers in this country have recently started the production of polyester resin-bonded glass fibre sheets

under the trade names of Cascalite (Cascelloid Ltd.), Galt-Glass (Durasteel Ltd.), Micorlite (Microcell Ltd.), Milite (F. G. Miles Ltd.), Sarolite (Saro Laminated Wood Products Ltd.), and Undulite (Ashdowns Ltd.). These translucent corrugated sheets are manufactured from glass fibre matts or woven glass cloth; the appearance of woven glass cloth is aesthetically more pleasing than that of glass fibre matt. The sheets are produced in up to 8 ft. or 10 ft. lengths and in widths of up to 4 ft., with various profiles to match corrugated metal and asbestos-cement sheets. The light transmission of a clear translucent sheet is 85%, in comparison with 91-92% for Perspex and 80% for ¼-in. wired glass.

Manufacturers of prefabricated buildings have already shown some interest in the possibilities of this type of translucent glazing, owing to the ease with which the sheets can be cut and drilled with ordinary tools and fixed in the same way as other sheet materials. Galt-Glass translucent corrugated sheets are now used for roof-lights in " Buckwyn Universal Buildings " (Bucks and Middlesex Estates, Ltd.). These buildings are constructed of tubular steel framing members, sheeted with corrugated aluminium or asbestos cement. The resin-bonded glass-fibre material is found particularly useful, because it can be easily pressed into any shape or form which the manufacturers require.

In prefabricated buildings, the lightness of components, ease of transport and fixing are important considerations. This applies not only to structural members and cladding panels, but also to accessory components, such as rainwater pipes, gutters and other fittings. The use of plastics in this field has been very little explored.

A certain amount of work has been carried out on the development of extruded p.v.c. rainwater pipes and some of these pipes were experimentally installed last year at Coventry and St. Albans. They were extruded, cut to the required lengths (up to 20 ft.) and fitted to the outlet at one end and to the gulley at the other end. The fact that they are extruded in one length without joints could readily be utilized for prefabricated buildings, the design of which is based on the production of repetitive units. These p.v.c. pipes are less rigid than metal pipes and therefore require holderbats spaced at more frequent intervals. As the material is liable to be damaged during transit or erection, care should be taken to prevent unsightly scratches.

Although the manufacture of gutters is quite feasible by cutting the pipe longitudinally into two halves, or extruding the gutter in one piece, the assembly already becomes more complicated. The moulding of special connections and outlets may not always be economical and it is preferable to have gutters formed in the roof itself, with a simple connection to a downpipe. At present the price of p.v.c. pipes is too high and, in spite of other advantages, the pipes cannot compete with traditional materials.

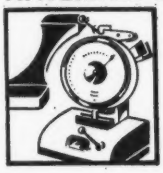
The principle of prefabrication has frequently been advocated as a means of economical building which justifies the use of more expensive materials, because of the saving achieved through the reduction of labour cost on the site. An analysis of the cost of materials and labour in the case of the Garston Day Nursery, which is a typical example, is very instructive. Prefabricated elements included a steel frame and Holoplast external walls and internal partitions. The percentage cost of the above in relation to the total building work was as follows: Steel frame 11.5%, external walls 16.4% and internal partitions 14.8%. These prefabricated elements, which required a minimum amount of site man-hours, although their cost was high, accounted for the figure of 0.27 site man-hours for every £1 spent, as against 2.08 for traditional elements, such as external works, drainage and floor screeds. A further analysis of the cost of external and internal walls showed that the cost of the material alone (" ex works ") amounted to 94%, erection to 5.6% and transport 0.4%. It may be relevant to mention that the cost of average brickwork when broken down into the elements of material and labour, amounts to 67% for the material and 33% for labour.

Galt-Glass corrugated sheet being placed into position.

Corrugated sheeting, Undulite, manufactured by Ashdowns Ltd.

World's Industry Employs Plastics

MATERIALS and TESTING



Moulding powder from fertilizer waste effluent.—Indian plastics industry was retarded by the lack of a cheap supply of home-produced phenols. Investigations are described for utilizing waste effluent from producer gas plants for recovering phenol, xulenols, cresols, etc.
(*Journal of Sci. and Ind. Research*, 1953/July/328.)

Plastics standards.—The American Society for Testing Materials has recently issued a 705-page booklet summarizing the hitherto established standards on plastics, including specifications, definitions and tests of a wide range of products.
(*A.S.T.M.*, 1916 Race Street, Philadelphia 3, Pa.)

Frictional behaviour of polymers.—Recent American research dealt with (a) effect of chemical constitution on frictional properties of linear high polymers made from halogenated derivatives of ethylene and (b) properties and applications of such polymers when firmly bonded to hard metal substrates. The report gives a full account of experimental methods used, the frictional properties observed and recent applications to lubrication.
(*Lubrication Engineering*, 1953/Aug./204.)

Testing plastics during heating.—W. Toeldte describes a new method. A tube for determining the melting point is placed in a special bath. The material to be tested need not be pulverized. The "flowing" can be found quantitatively by "feeling" with a glass rod.
(*Kunststoffe*, 1953/July/271.)

Tracking and arc resistance.—Intended standard testing methods are briefly discussed and results compared. In contrast to common beliefs, it is concluded that it should be possible to find one common testing method for the different types of resistance.
(*Kunststoffe*, 1953/July/254.)

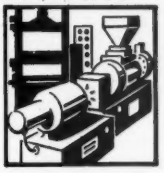
Thermal properties of butadiene-styrene copolymers.—Workers at the National Bureau of Standards studied the effects of heat treatment on heat capacity and the glass-transformation temperature.
(*Journ. Research, Nat. Bur. Standards*, 1953/June/357; Research Paper 2425.)

Crazing stress in polymethyl methacrylate.—M. A. Sherman and B. M. Axilrod determined stress and strain at 23°, 50° and 70° C. Load elongation plots were made; the onset of crazing was observed visually and noted on the graph.
(*A.S.T.M. Bulletin*, 1953/July/65.)

Transitions in Teflon.—Workers at the Nat. Bureau of Standards found that Teflon p.t.pl. is unique among all high polymers investigated to date in that it exists in three polymorphic forms.
(*A.S.T.M. Bulletin*, 1953/July/71.)

Chlorotrifluoroethylene.—The polymerization of this new plastic can be accelerated by silver nitrate-catalysts.
(*Industrial and Engineering Chemistry*, 1953/June/134.)

PROCESSES : MACHINERY

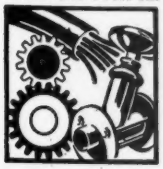


Injection moulds for thermoplastics. — G. Thilenius gives a survey on the design of moulds, in particular those with undercuts. Ejectors, cooling, heating and the economic number of pieces per mould are discussed.
(*Kunststoffe*, 1953/July/285.)

Theory of extrusion.—I. F. Carley and collaborators presented seven papers on their work on the theory of extrusion presses carried out in the laboratories of E. I. du Pont de Nemours and Co.
(*Industrial and Engineering Chemistry*, 1953/May/969.)

Electrical heating devices for rollers and drying cylinders.—K. Neef describes a number of new designs fulfilling the requirements for higher temperatures and working speeds.
(*Kunststoffe*, 1953/June/245.)

INDUSTRIAL APPLICATIONS



Metal-clad laminates in printed circuits.—Printed circuits are practical principally owing to their simplicity and uniformity. They are particularly adaptable to very complex commutators and switching networks, where small size is required. Materials, bonding and methods of fabrication are given.
(*Mechanical Engineering*, 1953/Sept./709.)

Plastics and Engineering.—Developments as seen in British industry have been described by W. M. York.
(*Machinery Lloyd* (Europ. Edn.), 1953/Aug. 22/52.)

Mounting metallurgical specimens.—P. A. Lovett describes several methods using a new type of hot- or cold-curing acrylic resin. The speed of curing is improved by gentle heating without pressure.
(*Metal Industry*, 1953/83/70.)

Clamping with plastics.—J. Beduar gives recommendations on the design of clamping fixtures in which plastics (Viniplast) are used as a fluid-transmitting element.
(*Feingeraetetechnik*, 1953/Aug./370.)

Embedding methods for ultra-thin microtome cuts.—K. John gives a survey of the methods used for electron microscopy and briefly discusses the application of polymers.
(*Mikroskopie*, 1953/5-6/179.)

Synthetic resins with epichlorhydrin.—J. Schrade gives a literary survey and describes the production of a thermoplastic, exploring the possibilities of converting it into a cured, non-melting polyplast.
(*Kunststoffe*, 1953/July/266.)

Synthetic-resin cements.—V. Evans deals with their properties and applications in the chemical industry, in particular in corrosion-resistant plants.
(*Chemistry and Industry*, 1953/21/504.)

MISCELLANEOUS USES

Prospects for the German plastics industry.—Consumption per head of population of 7.5 kg. in the U.S.A. is compared with 4.5 kg. in the Federal Republic and 3.9 kg. in Great Britain. The established increases for 1955 are given, 12.5, 6.25, and 5.4 kg. respectively. To realize this estimate as far as Western Germany is concerned, considerable work in creating home markets and increasing industrial applications is required.
(*Chemische Industrie*, 1953/Oct./694.)

Post-war development of Japanese plastics industry is discussed in a brief survey quoting production figures for recent years of plastics plasticizers and relevant chemical raw materials.
(*Chemische Industrie*, 1953/Oct./696.)

Growth of petrochemicals industry.—This industry now supplies close to 25% of U.S. chemical needs and is expected to supply 50% by 1965. Breakdown of end uses for 1952 shows the far largest customers to be rubber 20%, motor and aircraft industry 17%, synthetic fibres 15%, and plastics 14%.
(*Chem. and Eng. News*, 1953/Oct.5/4074.)

Outlook for plastics raw materials.—World production of plastics in the next 20 to 30 years is estimated to increase ten-fold to 15 million tons per annum. The problems of raw materials to meet this increase are discussed with reference to three basic substances. The survey quotes interesting production figures for U.S.A. and the world.
(*Chemische Industrie*, 1953/Oct./691.)

Hard vinyl material for name plates.—Lucoflex rigid p.v.c., made by American Lucoflex Inc., 500 5th Avenue, New York City, is said to resist action of most solvents, brine and other corrosives, and to have a metal-like machinability.
(*Machinery* (N.Y.), 1953/June/175.)

Five plastics exhibitions in Europe.—A general survey of the exhibitions in the first half-year of 1953: Oyonnax, Milan, Barcelona, London and Paris.
(*Kunststoffe*, 1953/July/261.)

Gutters and gutterpipes of polyvinyl chloride.—Jangmichel gives a survey on the application and use of polyvinyl chloride for gutters and gutterpipes.
(*Chemische Tecknick* (Berlin), 1953/No. 9.)

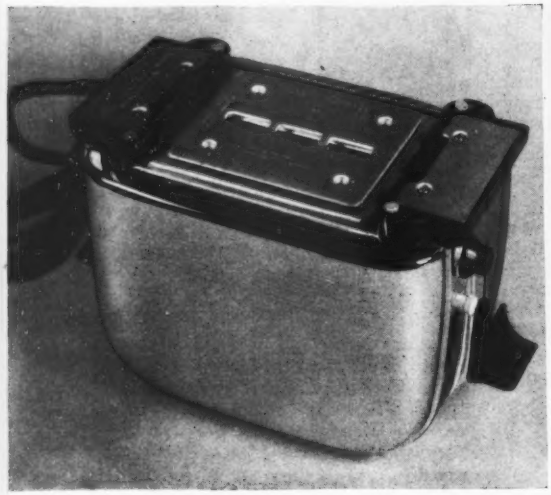
Glass-reinforced plastics wings.—I. Stone describes the fabrication of wings at the Wright Air Development Centre.
(*Aviation Week* (New York), 1953/22/50.)

Coloured plastics.—New developments in the colouring of plastics, in particular the importance of Polymon dyes, are dealt with.
(*Australian Plastics*, 1953/93/34.)

PLASTICS
IN THE SERVICE OF MAN

A pictorial review of high-quality units moulded or otherwise fabricated in Great Britain . . .

43. Electrical Household Appliances—1



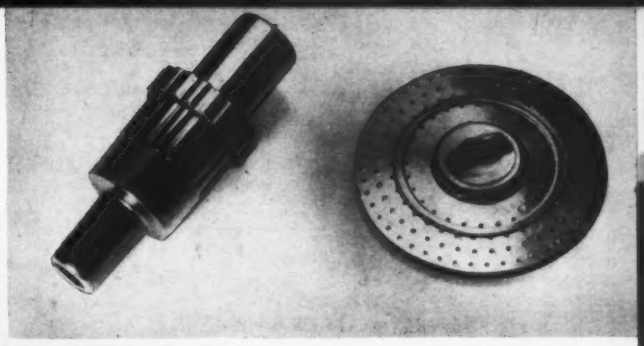
(Above) This unusual view of the Morphy-Richards electric toaster shows the moulded phenolic base components and handle.

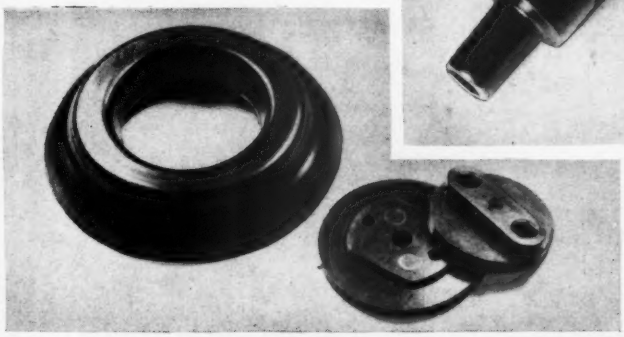
(Above and right) The Morphy-Richards hair dryer has housing moulded in two parts from urea plastics, impeller injection moulded in polystyrene and switch components and grille moulded in phenolic.

(Above and left) Plastics employed in the Servis domestic electric washing machines made by Wilkins and Mitchell Ltd., include mineral filled, heat and detergent resistant phenolic agitator, water-lubricated moulded nylon wringer bearings, extruded p.v.c. band round cabinet and various phenolic switches and handles.

(Right) The Atlantic, Senior and Travel irons all made by Morphy-Richards, Ltd., are here seen with the phenolic handles, knobs, etc., used in their construction.

(Right) Round brush back for President floor polisher and de-mothing tool from President cleaner, moulded in phenolic material for Bylock Electric Ltd.

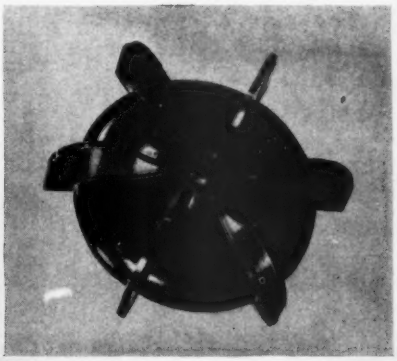




(Left) These black phenolic mouldings are components for the hand-dryer made by Bylock Electric Ltd.

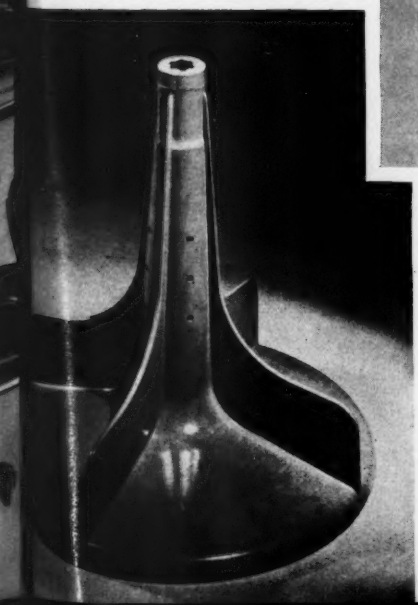
bove and below) The Carefree othes washer made by Carefree omestic Appliances Ltd., is de-gned to stand freely in the normal nk. The housing is moulded by alex Ltd., from black and maroon phenolic material.

(Above) Miscellaneous moulded components manufactured by General Electric Co. Ltd., Witton Moulded Insulation Works, include iron handles, TV aerial holder, lamp socket and valve holder, all produced by transfer moulding.

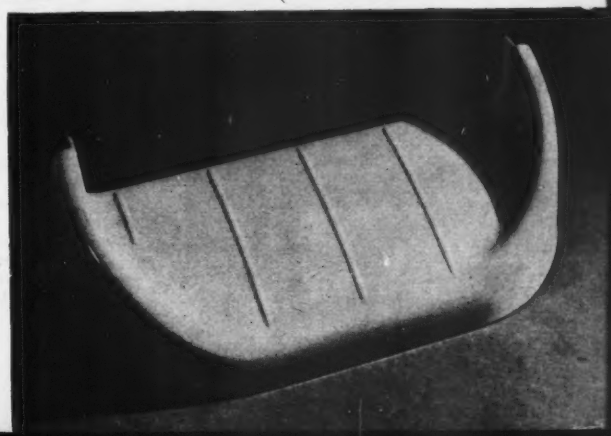


(Above) These components moulded in mottled walnut phenolic material form the housing of the Simoon hair dryer made by Bylock Electric Ltd.

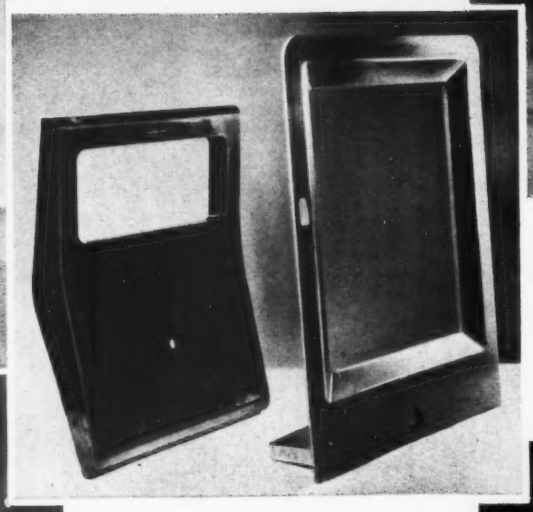
(Below) Clothes guard for washing machine wringer is injection moulded in polystyrene by G.E.C. Ltd., Witton Moulded Insulation Works.



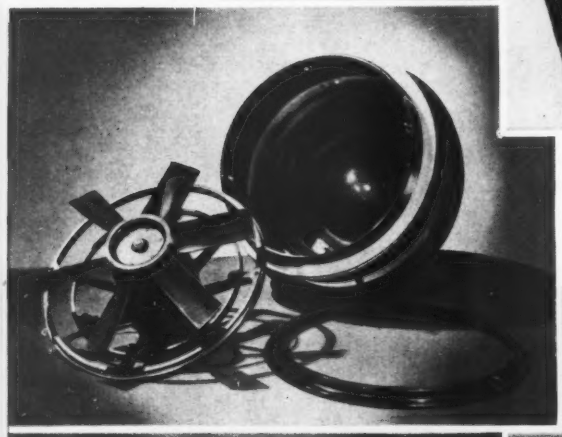
(Above and left) G.E.C., Witton Moulded Insulation Works, produce components for G.E.C. and other household equipment, including the high-speed impeller fan for hair dryer (above) and heat-resistant, water-resistant washing machine agitator (left), both in phenolic.



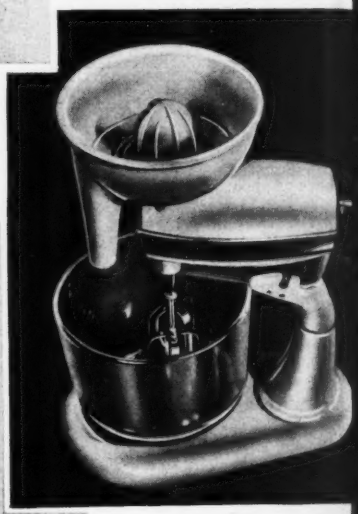
(Right and below) The extensive use of phenolic components moulded by British Moulded Plastics, Ltd., for the Vent-Axia fans was recently described in "Plastics" (October, 1953, p. 333).

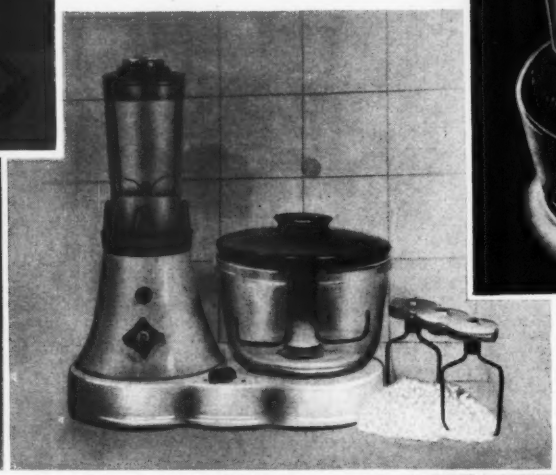


(Above and left) Mouldings from E. K. Cole, Ltd., Plastics Division, for household appliances included flexible p.v.c. components for the Hoover vacuum cleaner (above), phenolic front for the Thermovent heater, and a refrigerator frame in high impact styrene.

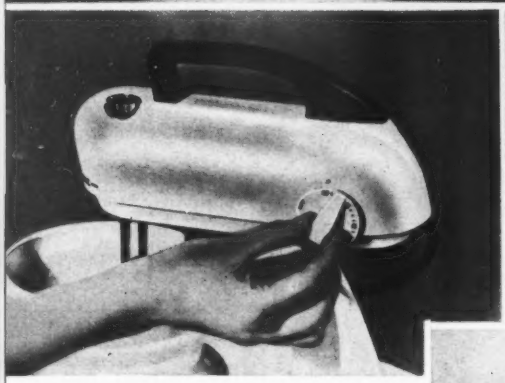


(Below) Plastics components for the Paladin food mixer are moulded by W. W. Ball and Sons, Ltd.

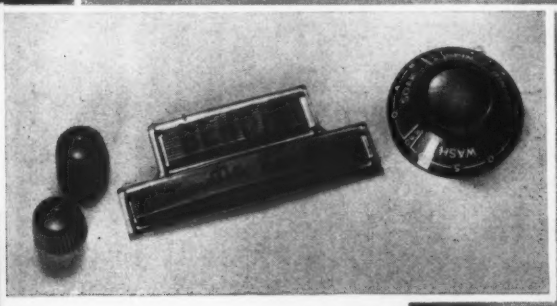




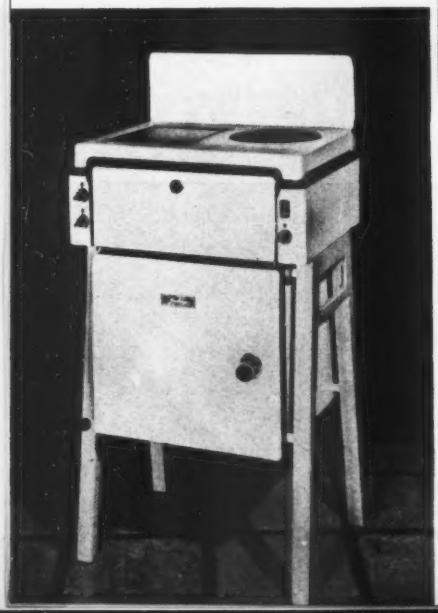
(Above) The de-juicer components of the Mary Ann food mixer are moulded in cream urea by W. W. Ball and Sons, Ltd.



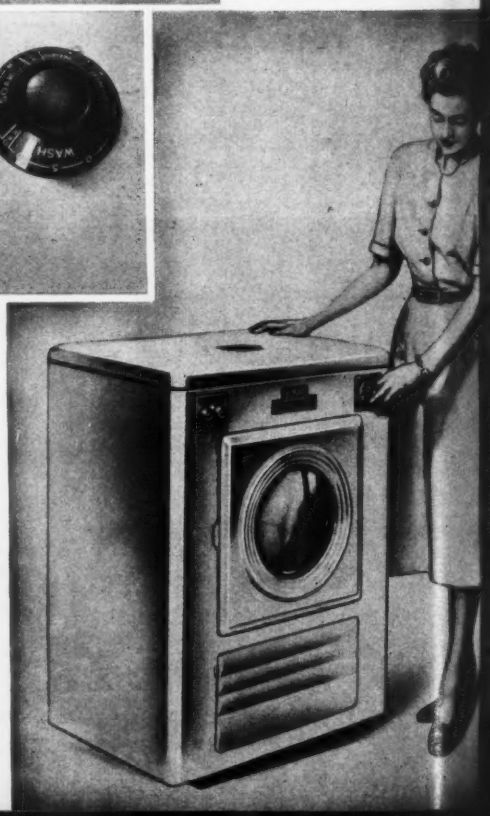
(Above) The food mixer produced by The English Electric Co., Ltd., employs a handle moulded from black Bakelite phenolic and a speed control knob of cream or white cellulose acetate.

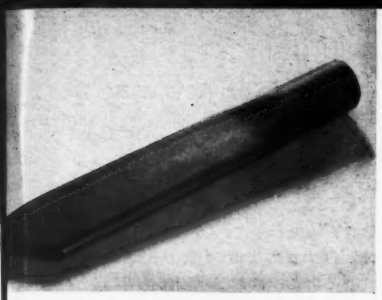


(Above and right) The automatic washing machine made by Bendix Home Appliances, Ltd., employs name plate, control knobs and dial moulded by Moulded Products, Ltd., Birmingham.



(Left) Important but unobtrusive plastic components are used on most electric cookers. The "Two-Ninety" model of Jackson Electric Stove Co., Ltd., has phenolic handles by Barclay-Stuart (Plastics), Ltd., and switch knobs moulded by Derwent Plastics, Ltd.

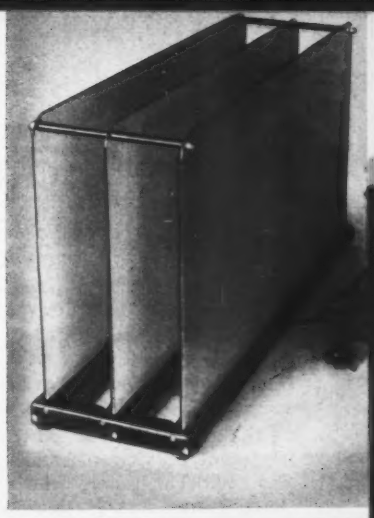


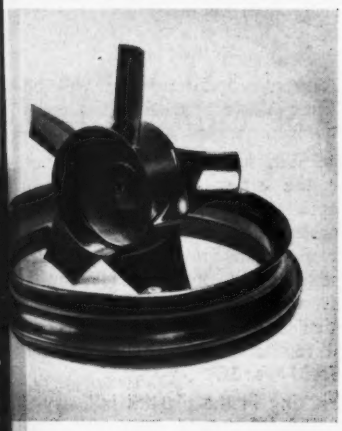


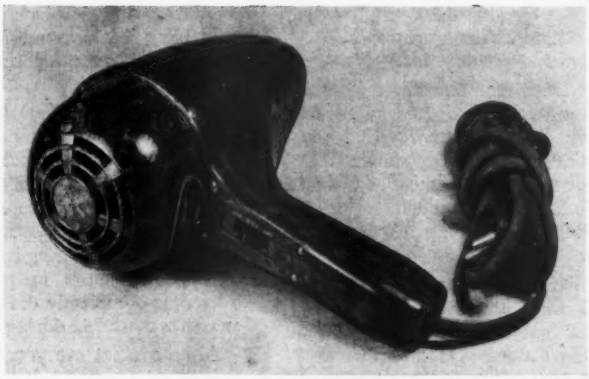
(Left) Suction cleaner nozzle fabricated from a rigid plastic extrusion made by Thos. De La Rue and Co. Ltd.

(Right) This heater and dryer design employing elements incorporated in laminates won a Horner's Company award in 1951. ("Plastics," December 1951, page 339.)

(Below) Components for the housing of the Siroma hair dryer were moulded in brown mottled phenolic by Metropolitan Plastics Ltd. (" Plastics," May 1950, page 138.)





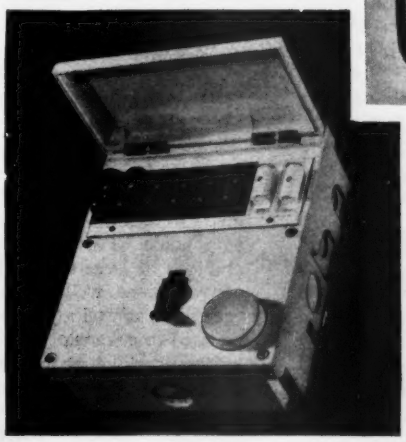


(Above) The impeller fan and ring housing of the Aerex fan are moulded from phenolic by W. E. Amies and Co. Ltd.

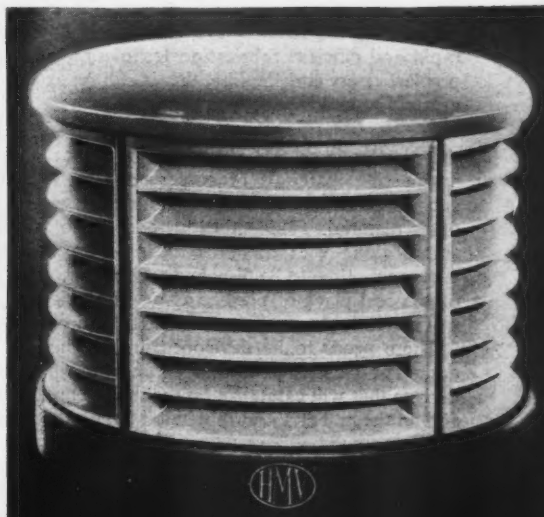
(Above) Spray gun adapter for the Electrolux suction cleaner is moulded by Ashdowns, Ltd. Phenolic mouldings produced by Ashdowns, Ltd. are used extensively as components for Electrolux suction cleaners (left). These mouldings combine smooth external appearance with intricate internal details (see lower illustration, left).

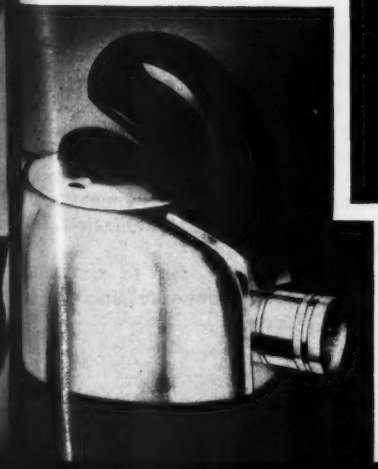
(Below) Fuse box designed and moulded by British Insulated Callender's Cables Ltd. is made from Scarab urea material (Photo: British Industrial Plastics Ltd.)

(Below) The top and louvres of the Cavendish Heater, made by H.M.V. Household Appliances, are phenolic mouldings with cream heat-resisting surface coating.



Above) Handle for Jelson Electric ron, screw-ring for Bylock Electric acuum cleaner, and red cooker andles for Almag Engineering o. Ltd. are moulded in Bakelite henolic by Coventry Motor and Sundries, Ltd.





(Left) The Bentinck electric kettle, made by H.M.V. Household Appliances, incorporates a black phenolic "steam shield" handle of excellent functional design.

The Education of the Plastics Engineer

As our readers know, the Editors of the "Journal of the Society of Plastics Engineers" *and of* "Plastics" *have, for some time, reproduced by mutual arrangement certain technical articles which have appeared in the* "*opposite*" *journal. We have gained much thereby. At the Ninth S.P.E. Technical Conference there was discussion on the subject under the above title and we have much pleasure in reproducing here, for future guidance, abstracts from some of the papers read.*

The Need for Plastics Engineers in Industry, by E. S. Bloom, (E. I. du Pont de Nemours, Inc.)

LET us first look at the requirements of industry from the point of view of numbers of engineers that might be needed. The survey which we have recently carried out among members of the plastics industry has shown that already there is a large unfilled demand for technical personnel with plastics engineering training, even though a really progressive plastics industry has been going for only a relatively short time.

Another factor which seems likely to influence the requirements for plastics engineers is that, as in the case of the chemical industry generally, the demand for technically trained people relative to non-technically trained personnel increases as the industry becomes older. As the industry becomes more mature the new technical developments take on greater significance relative to the original empirical approaches.

The processing or conversion of plastics materials is essential in almost all cases of their utilization. In this connection, a basic understanding of viscous flow is important to various conversion methods. Thus it is believed that additional training and instruction in the rheology of polymer melts to develop a better grasp of the mathematical treatment of problems in viscous flow of non-Newtonian materials would be much worthwhile. A broad knowledge of the information related to heat transfer would be useful in many phases of the plastics industry. Although some might consider heat transfer to be of the greatest importance in the polymer synthesis phase, it is certainly a major factor in the plastics processing operations, both from the point of view of getting heat into the plastics and removing it from them, since excessive heating is frequently deleterious.

A thorough understanding of the new developments in plastics processing or conversion would be a valuable background for engineers working in the plastics industry. Illustrations are the moulding theory developed by Spencer and Dillon, of Dow, and the extrusion theory and design recently developed and reported by researchers in the Polychemicals Department of the Du Pont Co. It is believed that knowledge of such information as this, plus a research attitude or approach, can lead to desirable imaginative approaches in the area of new fabrication techniques. Although great strides have been made in developing more rapid and efficient fabrication techniques through the use of preplasticizers and the like, this is still an area that needs the greatest attention.

For the greatest advancement to take place in the industry, the plastics engineers must recognize that plastics are new engineering materials of construction. They must not be considered simply as substitutes in a given design for some other material. This substitute-concept, of course, generally comes along with the introduction of a new material and takes some time to be dispelled. However, a full appreciation of the real place of plastics as new materials of construction will certainly do much to promote their proper utilization.

There needs to be developed an imaginative approach to design of plastics parts and equipment which leads to new designs that will capitalize on the unique properties of plastics and on the potentialities of new fabrication techniques. Again, it is basic background in current operations that will be valuable in promoting this imaginative approach that is so greatly needed.

A greater appreciation of the important properties of plastics, and in particular the stress-time behaviour, is important to the proper applications of the materials as engineering materials of construction. Undoubtedly in the present plastics courses most of the more important properties and their methods of determination are considered. We must be sure that attention is given to those properties that are controlling factors in particular applications in order to overcome completely the bad reputation that plastics received as ersatz materials during World War II.

Although not everyone working in the plastics industry is going to be called upon to design a mould, many will, and even those who are not can benefit by a knowledge of the elements of mould design. Sufficient attention should be given to this so that all are familiar with the problems that confront the mould designer. This, of course, is an important part of the knowledge of present fabrication techniques, and it also requires a knowledge of the properties of molten polymers. All people who are concerned with the design of products which will be important in promoting the plastics industry must be taught to realize that these products must be functional—that is, they will serve a purpose—and that they must also be practicable to produce. A frequent complaint by users of plastics parts has been the difficulty in getting efficient co-operation between their parts designers and the mould designers and manufacturers. Too often much time is wasted because the mould designer contracts for a particular job only to find out several months later that it is impractical—in the meantime, the customer has proceeded with the rest of his layout based on the original design, all of which may then require extensive revision. I am sure that much of this tremendous waste can be prevented by a better understanding of mould design and of the properties of plastics by all concerned.

A Survey of Industry to Determine the Demand for College-trained Plastics Engineers, by R. C. Barlett, (Natvar Corporation)

TO evaluate the current industrial needs for and interests in "plastics engineers," a survey has been made. This was designed to determine the demand by industry for personnel having a training as outlined by the S.P.E. brochure entitled "Professional Engineering Education in Plastics." Considerable care has been taken to put this survey on as broad a basis as possible. For example, care has been taken to solicit the opinions of large as well as small industrial organizations, of converters as well as raw-material manufacturers, and of executives as well as engineers. Furthermore, this survey was planned to cover not only the plastics industry, but also those industries which manufacture products involving the use of plastics materials as component parts. This last category includes industries such as the aircraft, automotive, electrical, heating, business machines, medical, communications, mechanical goods, military, electric power, toy, abrasives, and transportation.

The questionnaires have been sent out to determine statistically the industrial interest in "plastics engineers." It

has been encouraging to have obtained a high yield of answers to this questionnaire, particularly since it could not be answered easily and quickly. This may reflect industrial interest in the general subject of education for technical personnel.

Without any qualification, the questions, along with their summarized answers obtained by this questionnaire, may be outlined as follows:—

First question: "Does your company have need for personnel with training described in the S.P.E. brochure?"
Answer: Yes, 98%; No, 2%.

Second question: "List particular types of jobs in which you believe men with this graduate training and the following undergraduate backgrounds would be especially qualified."

(a) Mechanical Engineering—Answer:

1. Design and development	52%
2. Research	4%
3. Technical sales and service	14%
4. Production	19%
5. Other	12%

(b) Electrical Engineering—Answer:

1. Design and development	50%
2. Research	9%
3. Technical sales and service	17%
4. Production	9%
5. Production control	7%
6. Other	9%

(c) Chemical Engineering—Answer:

1. Design and development	38%
2. Research	16%
3. Technical sales and service	11%
4. Production	23%
5. Materials engineering	3%
6. Other	9%

(d) Aeronautical Engineering—Answer:

1. Design and development	71%
2. Technical sales and service	14%
3. Other	14%

(e) Chemistry—Answer:

1. Design and development	44%
2. Research	36%
3. Technical sales and service	7%
4. Production	9%
5. Other	4%

Third question: "Check which of the following ways you believe men with such training could be of special value to your organization."

(a) Research—Answer: 15%
(b) Development—Answer: 21%
(c) Product Design—Answer: 14%
(d) Production—Answer: 11%
(e) Production control—Answer: 10%
(f) Technical sales and service—Answer: 28%

Fourth question: "To what extent does your company find it necessary to provide on-the-job training in plastics?"

Answer: Many varied replies were obtained here, but they may be briefly summarized as:—
Do provide job training, 98%.
Do not provide job training, 2%.

Fifth question: "Which men would be preferable to your organization?"

(a) A B.S. with a M.S. in the same field.—Answer: 14%.
(b) A B.S. with a M.S. in plastics as described in the S.P.E. brochure.—Answer: 76%.

By a 98% response to questions one and four, it is clear that the plastics industry looks upon the S.P.E. outline for "Professional Engineering Education in Plastics" with favour and is realistically confronted with this problem when industry now supplies most of the present education in this profession. From the numerous comments added to this questionnaire, it is apparent that industry expects to spend anywhere from three months to three years training their personnel before they become productive in this field. In general, it appears that the plastics industry is not satisfied with on-the-job training of their engineers and believes that the longer industrial training programmes can be materially shortened by engineering education sponsored by the S.P.E. Education of technical personnel in the plastics industry is recognized as a major problem by both large and small organizations. I would venture a conservative estimate from the comments received on this questionnaire that industry spends over one million dollars a year in both tangible and intangible educational expenses. This large burden carried by industry may result from the combined lack of formal educational facilities and the relative newness of this profession.

Of particular interest, and an unexpected outcome from this survey, was the formation of a picture of the ways an engineer is employed in the plastics industry. Through this questionnaire it has been possible to arrive at a general statistical definition of a plastics engineer. Due to the lack of plastics engineers in the pure sense, industry has expressed its interests in other branches of the engineering profession as alternates in the following order of descending preference: chemical engineering, mechanical engineering, chemistry, electrical engineering, and last, aeronautical engineering. Results of this survey also show that a plastics engineer is most likely to be employed in research or development, and after this he will most probably participate in technical sales and service.

Of particular interest is an analysis of the problem of replacement of men currently employed in the plastics industry. Assuming that the useful working life of a plastics engineer is 45 years, that the age distribution is uniform, and that the plastics industry is not expanding; it is estimated from 50 to 75 technicians are required per year only for replacement. Obviously, the last two assumptions are incorrect, particularly the supposition that the plastics industry will not grow. However, this does make this estimate of replacement very conservative. Considering the growth of our industry alone, this estimate can be multiplied by a factor of about five in 1963. On top of this is the problem of supplying a larger body of engineers to man a rapidly growing industry.

It is the desire of the Educational Committee of the S.P.E. to continue this survey, so that a more exact answer can be obtained to the general problem of education of plastics engineers. This analysis is based on the results of this survey as it now stands. Accordingly, precautions have been taken to avoid making any conclusions where trends are not clearly shown.

The Future Training of Plastics Engineers, by Bryce Maxwell, Princeton University

WE have read something about the needs of industry for plastics engineers, the present status of plastics education and industry's demand for men with improved technical training. I should like to describe how the programme of the S.P.E. Educational Committee is directed towards a solution to these problems.

As many of you know, in 1949 the Educational Committee prepared and presented to the Society a programme for Professional Engineering Education in Plastics. This programme was directed towards the establishment of a standard curriculum at the graduate level for the training of Bachelors of Science in mechanical, electrical or chemical engineering,

(*Continued on page 388*)

The Rate of Strain Factor in Relation to the Impact Strength Properties of Plastics

By R. N. HAWARD*

The effect of the rate of strain on the energy required to fracture plastics materials is reviewed, with particular relation to simpler types of test piece. A particular case is considered and it is concluded that at the highest rates of strain the stresses imposed are such that the rate of fracture overtakes the rate of strain.

THE impact strength of plastics materials is currently investigated and measured by tests of many different types. Although there is a good deal of agreement between different tests when materials of widely different impact strength are compared, there are many differences in detail, and these may even lead to a reversal of the order in which materials are classed when different tests are used. Currently the type of test most frequently employed, and one which is backed by much practical experience, is the notched bar test. Many versions of this test have been used, but in general they all differ from conventional static deformation and fracture tests in two ways. First, a point of stress concentration is created in the test piece, so that the energy to fracture is taken up over a small volume of material and in a region of complicated combined stresses. Secondly, the rate of strain of the specimen is increased as compared with a static test. Both these aspects contribute to the significance of the test, but from the theoretical point of view it is necessary to separate them and identify the different factors involved. For this reason it is very convenient to investigate the influence of rate of strain by making tests with a more simple geometry, allowing for direct comparison between slow and fast experiments. As will be seen later, the various effects introduced by such changes are fairly complicated and still far from being completely understood so that the restriction to simple shapes seems to be necessary. It is the object of this article to consider the rate of strain effects in relation to energy absorption by plastics. It should, however, be appreciated that the specific effects of notches in concentrating the stress at the point of fracture are of great practical importance and that in some cases the whole theory of impact strength has been centred round this point.[1] Further, in the case of polythene it has been shown that very substantial differences occur when the condition of stressing is changed from simple tension to biaxial tension.[2] Nevertheless, the view adopted here is that the consideration of rate of strain effects in relation to test pieces of simple geometrical design is also of great interest.

A point of great importance in considering energy absorption of plastics and the rate of strain effects on the complementary problem of the relation between static and dynamic testing is the very large number of phenomena which may be concerned when these changes are made. In particular, the following effects have to be considered in relation to any drastic changes in the rate of strain:

1. Changes in fracture strength.
2. Changes in deformation and the relative contribution of different types of deformation.
3. The conditions of the process may involve transition from isothermal to adiabatic processes.
4. Inertia factors may arise at high rates of strain.
5. There may be an effect due to the combination of masses between striker and test piece.[3] However, this factor seems to require the absorption of energy at the point of collision. Its practical application to impact problems does not seem to have been developed.
6. In a bending test the type of bending relationship may alter, e.g. in a long, thin beam the deviation from the assumed equations of bending may be greater in one case than in another.
7. There may be differences due to the efficiency of the machines and methods of measurement employed.

It is proposed to discuss here mainly factors 1. to 4. above in particular relation to plastic materials.

* Petrochemicals, Ltd.

Types of Deformation in Plastic Materials

As is well known, plastic materials, especially thermoplastics, are capable of different types of deformation and these are commonly summarized according to Tuckett's formulation.[4]

$$D \text{ total deformation} = D_{OE} + D_{HE} + D_{visc}$$

where D_{OE} is the ordinary or Hookean elastic deformation.
D_{HE} is the element of high elasticity, i.e., the true rubber-like deformation.[5]
D_{visc} is the viscous deformation or true flow of the material.

Ordinary Hookean Elasticity

In making use of this very convenient formulation of deformation properties it should, however, be appreciated that each material has its peculiarities, so that it is necessary to clarify the applicability of the relationship to a certain extent in each case. This is never more important than with the true or Hookean elasticity. The assumed properties of this type of elasticity are that it is "ideal" and proportional to the stress, i.e. not time dependent and adequately represented by the appropriate group of constant elastic moduli in accordance with the classical theories of elasticity. Such behaviour is characteristic of many metals below their yield point and particularly of the true glasses over their whole range of behaviour at normal temperatures, which is a reason why the mechanical properties of glasses are of particular interest. It is also clear that many plastic materials, more particularly of the harder and more glassy type, show a fairly well-defined deformation, corresponding closely with the requirements of an ideal Hookean deformation over a wide range of times and temperatures. For example, Welch and Quackenbos[6] examined the elastic modulus of various phenolic resins both under static conditions and in vibration experiments (times of the order of 10^{-3} sec.). They found that the dynamic moduli were only very slightly above those found in the static experiments. Similar results were obtained by Liander, Schaub and Asplund,[7] who found a quantitative agreement between dynamic and static moduli for some thermosetting materials and for Perspex (polymethyl methacrylate sheet). With polystyrene Schneider and Barton[8] found a value of 5.6×10^5 p.s.i. for the Young's modulus, using an ultrasonic technique, a value only slightly above the normally quoted figure of 4 to 5×10^5.[9] On the other hand, Kolsky[10] working with Perspex (polymethyl methacrylate) sheet observed a several-fold increase in the modulus, at times of the order of 20 microseconds.

Some light on this factor may be shown by the curves obtained by Lethersich[11] in the case of polystyrene (Fig. 1). It will be seen that the strain-time curves flatten out at short

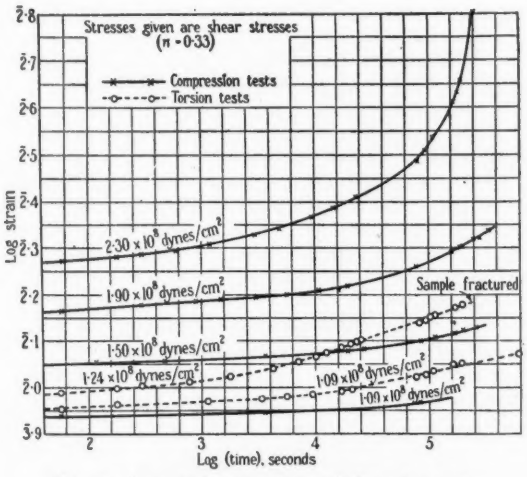


Fig. 1.—Log strain—log time relations for polystyrene in shear and in compression[1].

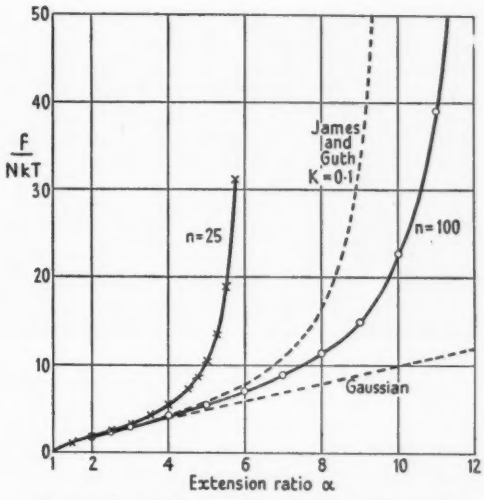


Fig. 2.—Comparison of experimental results with theoretical curves.

times and low stresses. At the two lower stresses, where the relation is nearly linear, the effect of time on deformation is very small, being of the order of 1% for a factor of 10 in time. On this basis one might extrapolate the conclusion that in proceeding from times of the order of minutes (static experiments) to those involving milliseconds one might expect changes in modulus of the order of 10%. This would support the idea that plastic materials exhibit a form of behaviour which is reasonably summarized by saying that they have an ideal Hookean modulus of elasticity. However, Kolsky's experiments also demonstrate the danger of extrapolating beyond the millisecond range, even with hard materials.

All this applies essentially to that part of the deformation of plastic materials which can be defined approximately as an ideal Hookean deformation. However, with many materials, this deformation is relatively small when compared with the true highly elastic deformation and this latter mainly determines the outcome of an impact test.

High Elasticity in Plastics

Rheologically speaking, a non-ideal elastic deformation is a reversible deformation not occurring instantaneously and not necessarily proportional to the applied stress. In many plastic materials there exists a type of elasticity, generally described as high elasticity, which is now known to be characteristic of the deformation of a network of long molecules.[5] In such a process the molecules are deformed from a random arrangement in such a way that the distance between the points of entanglement or cross-linkage is increased in the direction of tension. In this way the molecules are, to a certain extent, aligned so that crystallization may be favoured whenever it can occur. Such deformations are opposed:

1. By the entropy differences involved in going from a random to a more ordered system.
2. By "viscous" forces which oppose any movement or rearrangement of the macromolecules.

The consequences of the first of these conditions has been very carefully worked out, since it is the characteristic feature of the rubbery materials, and it has been shown that in the case of moderate extensions, i.e. in this case up to about 400%, the behaviour of a rubber can be represented thus[5]:

$$f = G\left(2 - \frac{1}{\alpha^2}\right) \quad \ldots\ldots\ldots\

Fig. 3. Effect of heat treatment on specimen of Perspex severely deformed during tensile tests (above) and compression tests (below).

When a highly elastic material is extended under conditions where viscous forces predominate, the extension is likely to continue until either:

1. Fracture occurs.
2. The network approaches the maximum extension of which it is capable, i.e. the part of the extension force curve which is nearly parallel with the force, as in Fig. 2.

In the latter case, the polymer may be said to have reached its "limit of extensibility." When this occurs the material will tend to be approximately the same elongation at infinite time over a range of different stresses, provided, of course, that sufficient time is allowed and that it does not break first. A case of this type will be discussed later. With many materials, however, both elastic and viscous forces play a part in the deformation so that delayed highly elastic deformations are obtained whose limit at long times depends on the applied stress, and whose rate of deformation is controlled by both elastic and viscous forces.

Viscous Deformation

At high temperatures most plastics are capable of true flow, i.e. the macromolecules as a whole move relatively to each other so that permanent changes of shape occur. Such flow also occurs with solutions of plastic materials and no doubt in a fair number of the highly plasticized or resinous products used in industry. However, it seems to be a relatively rare phenomenon in most of the high polymers at normal temperatures. It has, however, been conclusively shown to occur with raw rubber under certain specified conditions.[18]

The Influence of Rate Factors on Impact Strength with Materials Showing Predominantly Hookean Elasticity

Materials in which only Hookean elasticity is observed or in which it predominates are generally regarded as brittle. Commonly they are recognized as being of the glassy type (though, of course, we should include opaque materials). Such materials have relatively low impact strength as compared with the tougher types of plastic material, since fracture occurs before large deformations can be brought about.

However, the fact that the impact strength is controlled by a deformation which may be approximately represented by appropriate time independent elastic constants does not mean that the impact strength is independent of rate of strain factors. It does, however, seem that such materials show a simpler type of behaviour than the tougher materials.

In general, the behaviour of the glassy materials at different rates of strain is determined by two major factors among those listed at the beginning of this article.

1. The fracture strength changes and in general increases as the time of fracture is reduced.
2. Inertia factors come in at high rates of strain.

With regard to the first of these factors, the effect is fairly general and now becoming increasingly recognized.[16, 17, 6, 15, 14] In many cases linear relations have been found between the fracture stress (or its log) and the log of the time of fracture. In the case of glass itself, the application of such relations has led to a fair agreement between calculated and measured impact strength at low velocities.[19]

There seems no doubt that the rise in fracture strength with short fracture times is a general phenomenon, but it has recently been shown that it is not universal in all circumstances. For example, Russel[20] found that this relationship is reversed in the case of tensile specimens with holes drilled in them. This may be due to the favourable effect of slow deformations in dispersing stress concentrations, but it is in any case an important exception to the general rule.

The question of inertia factors is, however, relatively neglected, partly no doubt because of the great difficulty in making an exact application of existing knowledge and partly because it is often more convenient to work in the lower velocity range, where such effects are less easily observed.

In principle, however, certain relevant facts have been known for a very long time. The simple case of longitudinal impact on an un-notched bar was worked out by Saint Venant and Flamant[21] in 1883. The essence of their conclusions is as follows. When a weight W, assumed to be rigid, strikes a long bar (Young's modulus E and S.G. ρ) with velocity Vo, as shown in Fig. 4, then the initial stress is not zero but equal to Vo $\sqrt{E\rho}$ (dynes).

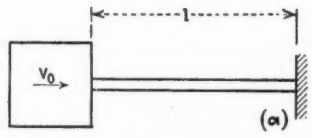


Fig. 4.

After the first impact the force between the weight and the end of the bar changes in a series of discontinuous jumps followed by declines, as shown in Fig. 5.[22] Here the initial stress (as above) is taken as unity and ∞ is the mass of the bar over the mass of the striker. In each case a momentary stress of at least 2 V $\sqrt{E\rho}$ is produced before the contact is broken off and when the velocity is appreciable the stress will reach values much above any that would be predicted by a treatment based on the static deformation of the bar.[22]

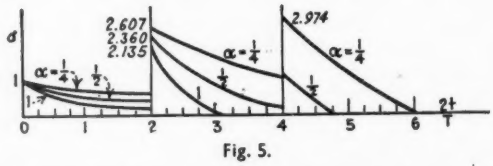


Fig. 5.

Unfortunately there is considerable difficulty in disentangling the contribution of inertia factors in any but the most simple experiments. However, the existence of such factors has been rigidly demonstrated from the point of view of the theory of elasticity and cannot be neglected in any material having mass. On the experimental side, it has been shown by White *et al*[23] in tension impact tests with wires that with increasing velocity of impact the first "plastic" deformation occurs at the far end where the stress wave is reflected. This corresponds with the theoretical predictions of Saint Venant[21] since the local stress is doubled where the wave is reflected from a terminal point. The actual velocities in this case were above those predicted by static experiments and this was taken to indicate that yield points were raised at short

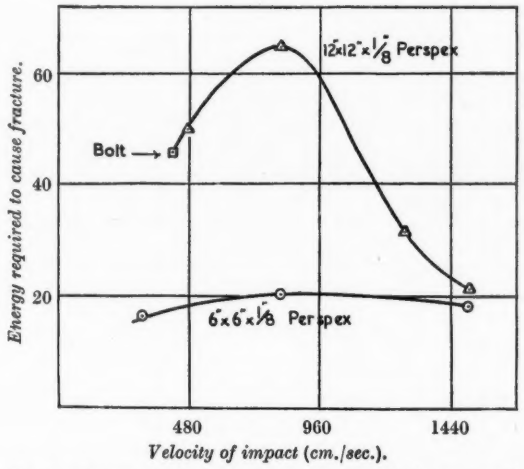


Fig. 6.—Energy required to cause fracture of singly supported sheets of Perspex by central impact at different velocities.

times. Other experiments on the impact of ball bearings on squares of plastics have shown very marked velocity sensitivity, undoubtedly due to inertia (Fig. 6)[24], but no adequate mathematical treatment has yet been worked out.

In all the above it has been assumed that the Hookean elasticity of the material is the only relevant figure, but it is, of course, possible in principle that other types of deformation take place under impact conditions, which reduce the value of E in the formula $V\sqrt{E\rho}$, and with many metals this is indeed the case, but on the whole, present indications suggest that with plastics non-ideal deformations tend to be reduced at high rates of strain. Therefore if they are not observed in a slow experiment they are unlikely to be encountered in a fast one. In any case, the values of $V\sqrt{E\rho}$, where E is the Hookean modulus, gave a maximum value of the stress of the initial elastic wave, or $2V\sqrt{E\rho}$ for a reflected wave, which, in tension impact, will not be exceeded, unless the time of the experiment is so fast that the constancy of the Hookean modulus cannot be relied on.

Rate Factors in Relation to Plastics Showing Non-ideal Deformations

All the plastic materials which characteristically show high impact strength also show considerable non-ideal deformation. With most thermoplastics this means delayed high elasticity, as argued previously. The extent to which this deformation takes place is controlled by the factors affecting the deformation or rate of deformation and fracture. It appears that this type of energy absorption has a tendency to disappear at high rates of strain for reasons which have in the first place nothing to do with inertia and which are discussed below. However, before dealing with this point it should be noted that wherever large deformations and energy absorptions occur there will be an adiabatic temperature change. Calculations show that these are only of the order of 10° C. for cellulose derivatives,[25] but with other materials where large deformations occur (e.g. more than 50%) it is necessary to consider the effect of correspondingly larger temperature changes.

All this, of course, applies only to that part of the energy used up in opposing viscous forces, since true high elastic energy is not converted to heat.

The consideration of rate of strain factors in relation to non-ideal elasticity is most readily carried out in connection with tension impact, as this reduces geometrical complications to a minimum. If we therefore consider the tensile impact model in relation to a variation in the rate of strain in the absence of inertia effects, i.e., at relatively low rates of strain, the following factors come into account.

(a) The fracture stress increases with the rate of strain, i.e. at shorter time.
(b) The rate of deformation increases with the stress or, conversely, the stress increases with the rate of deformation.

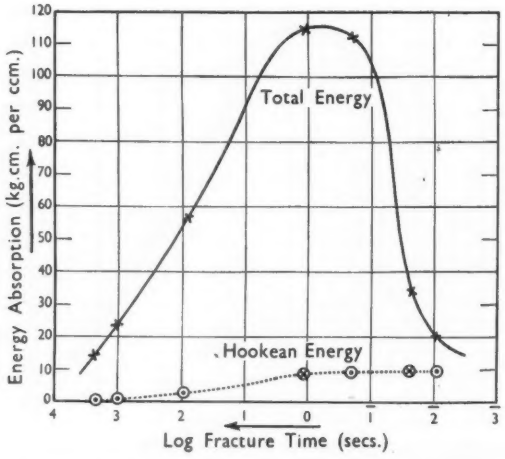
In the treatment of this problem which has been proposed by the author these two factors are treated as separate properties and the plastic is assumed to break whenever the stress imposed by the deformation or rate of deformation exceeded the fracture stress under the appropriate conditions. In general, very few plastics have been investigated over a sufficiently wide range of conditions to enable an energy/rate of strain curve to be predicted from separate deformation and fracture experiments. However, in the case of certain experiments on highly plasticized cellulose acetate[25] the author worked out empirical relations for deformation and fracture at constant load, which allow of the possibility of calculating an approximate energy absorption/time of fracture curve. The material showed the following characteristics:—

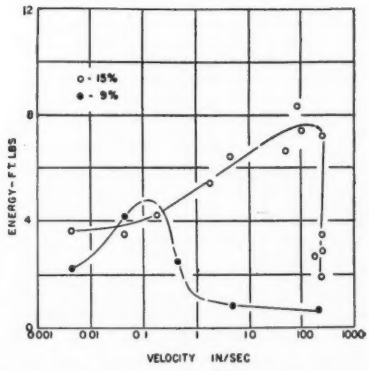
1. A limit of extensibility almost independent of stress equal to 0.53.
2. A rate of non-ideal elastic deformation increasing very rapidly with stress and reproducible as a power law involving $S^{6.5}$.
3. A time of fracture decreasing with increasing load at low loads, and approximating to a cube law, but tending also to an upper limit at high loads of 210 kg./cm.^{2} when fracture took place at zero time.
4. A Hookean elasticity of 2,400 kg./cm.^{2}

In constructing a rate of strain/energy curve for these data, which were determined in constant-load tests, the procedure is to construct a series of theoretical experiments at different loads and then to plot energy against fracture time. Such " experiments " are not exact reproductions of a tensile impact test, as the load and not the rate of deformation is the constant factor in each test, but the analogy of the effect of increasing load and increasing rate of strain is probably close enough for the qualitative conclusions to apply to the material in question. The results of this calculation are given in Fig. 7 side-by-side with those of Maxwell, Harrington and Monica[16] for plasticized ethyl cellulose (Fig. 8). It will be seen that the two curves have a sufficient similarity to suggest that the same phenomenon is represented in each case. However, with the cellulose acetate model one naturally enjoys the advantage of being able to see exactly what are the factors involved in the rise and fall of energy absorption. These are:—

1. Increase in deformation and load with rate of strain at low rates of strain because the rate of deformation increases more rapidly than the reciprocal of the breaking time, i.e. in this region the rate of deformation is overtaking the rate of fracture factor.
2. A region where the maximum deformation is reached but where the energy increases because the load is increasing.
3. A region where the load approaches the maximum at which fracture is assumed to occur in zero time. Here the opposite description prevails to that described in (1).
4. A relatively small Hookean absorption given by $\frac{1}{2}S^2/E$ which increases with rate of strain. This takes no account of increase in E at low times which might well have been appreciable with this material.

Of all the assumptions involved in the equations leading to these results, the most contentious is that involved in the factor 3 where absolute maximum of stress is assumed. This has not generally been observed with other plastic materials, though it has also been reported for polymethyl methacrylate sheet.[26] Nevertheless, it should be appreciated that an absolute limit is not essential for such a physical effect. What is





Strain/energy curves for (left) Fig. 7.—Cellulose acetate, and (right) Fig. 8.—Ethyl cellulose.

necessary is only that the fracture time diminishes more suddenly than the rate of strain increases. As regards the actual quantities given in Fig. 7, it should be noted that there are indications that the fall in energy absorption actually occurs at shorter times than those predicted by extrapolating the equations as have been done here[15].

It will, however, be appreciated that a number of specific factors have to be assumed in order to account for an energy/rate of strain curve of the type shown. This is, however, not at all impossible, especially in view of the very varied behaviour of the different thermoplastics investigated by Maxwell *et al*[16]. In any case, the calculations for the cellulose acetate model make it possible to demonstrate the manner in which a non-ideal elastic deformation can " cut in " and " cut out " as the rate of strain is increased. None of the assumptions involved brings in the question of inertia in any way.

The question therefore remains as to what is to be expected theoretically when inertia begins to play a part in the energy take-up of a material showing a non-ideal highly elastic deformation under tensile impact conditions. In such cases it may be noted that the rate of deformation may increase very rapidly as the stress is increased. With a material of this type the effect of increasing the load discontinuously in a series of steps might become considerable as soon as the size of the steps becomes of the order of, say, 20% of the breaking load. In such circumstances the final step might cause the load to reach a point where fracture occurred by rising suddenly from a previous value where the non-ideal deformation rate was still low. Further, since the stress change at a point of wave reflection is given by $2V\sqrt{E\rho}$ in the case of simple tension impact, it follows that the lowest velocity at which the inertia effect might be expected to start reducing a non-ideal elastic deformation would be of the order of V′ where

$$V' \sim \frac{\text{Tensile strength}}{10\sqrt{E\rho}}$$

taking a plastic with a Hookean modulus of 400,000 p.s.i., tensile strength 10,000 p.s.i. and specific gravity 1.3, this gives a value of $V' \sim 150$ in. per sec. This factor could, therefore, account for some of the phenomena observed by Maxwell *et al*[16] when sharp falls in energy absorption occur in the range of 100-1,000 in./sec. In any case, it would appear that when inertia factors do come in at the highest rates of strain they can have the effect of intensifying the conditions which lead to a reduction in high elastic deformation and energy absorption as previously outlined.

Summary

The effect of the rate of strain on the energy required to fracture plastic materials is reviewed, with particular relation to simpler types of test piece. With the harder or more glassy type of material the main factors are those of inertia and of the change in fracture strength with the time of the experiment. With materials showing appreciable high elasticity the energy absorption is much higher and depends mainly on whether or not the highly elastic deformation can occur under the conditions of the test. A particular case is considered and it is concluded that at the highest rates of strain the stresses imposed are such that the rate of fracture overtakes the rate of strain. Under such conditions the energy to fracture falls at high rates of strain. Inertia factors would be expected to intensify this effect.

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Plastics in the Tropics

JUST published is Report No. 2—Polythene, in the series issued by the Ministry of Supply on plastics in the tropics, obtainable from H.M. Stationery Office, price 2s.

Two grades of polythene, each with and without the incorporation of carbon black, were exposed for three, six and twelve months to Nigerian jungle, semi-desert, and surf beach climates. As a result all samples experienced slight weight loss and shrinkage. Tensile strength remained substantially unchanged, but under desert and beach conditions embrittlement occurred as indicated by a loss of extensibility and flexibility and rise of cold bend temperature. The permittivity altered very slightly, but the power factor rose considerably. The presence of carbon black reduced the growth of fungi.

The report contains copious tabular information covering changes in weight, tensile strength results, power factor results, etc. Illustrations are also included as well as graphs showing the effect of exposure on power factor.

LETTERS TO THE EDITOR

Correspondents are reminded that a stamped and addressed envelope should be enclosed in all cases where a personal answer is desired. It is understood that any letter received may be published at the discretion of the Editor.

The Problem of Scrap

SIR,—I have read with interest your article and the letters on the subject of thermoplastic scrap, and feel that one very important fact has not received the attention it deserves.

Your contributors have gone to great pains to evaluate formulæ and to express the result of degrading material in terms of known factors and even to the extent of suggesting values for a final loss percentage.

For myself I feel that although vitally important it is practically impossible to assess a value since there is one considerable factor which is an unknown, namely the rate of degradation of material related to the job.

For example, if I am moulding a small moulding well within the plasticizing capacity of the machine the material is not being plasticized at a high heat intake and is unlikely to degrade rapidly. The sprues and runners could probably be returned immediately to the press and the percentage of virgin material will be related to the size of the moulding.

At the other extreme—i.e., a fast running job on the top capacity of the machine is being plasticized at a high heat intake rate and degrading takes place very rapidly. It is extremely doubtful whether this could be re-used immediately and if not would probably have to have a heavy additive of virgin material, lubricant, etc., before it was readily reworkable. The high heat intake would probably be more detrimental in those cases where the material colour is likely to also suffer.

A second very important point is the difficulty of keeping the material destined for re-use in a satisfactory condition. It has been noticed that moulding shops are not always the most dust-free places and that human nature has a tendency to promote the leaving of drums open—tins without lids and even the putting of clean scrap into uncleaned containers. In the case of polystyrene the static attraction only makes the problem harder.

In my opinion if a check were taken—not of the material re-used after moulding but of the total unusable material at stock-taking (if it were all kept)—and expressed in terms of a percentage of the weight of mouldings delivered, or of total material issued, the resultant value would be considerably higher than some of us tend to imagine.

J. S. WALKER,
Technical Director.
Fraser and Glass Ltd.,
Woodside Lane,
North Finchley,
London, N.12.

Fishnets

SIR,—Could you give us the names and addresses of manufacturers who supply a plastic net, suitable for catching small fish in aquariums, also to use as breeding baskets.

RELIANT GLASS SUPPLIES.
147 St. Albans Road,
Watford, Herts.

[EDITOR'S NOTE: These could be made either from nylon monofilament or Tygan monofilament, in which case, no doubt, Fothergill and Harvey, Ltd., 37 Peter Street, Manchester, 2, could supply, or, alternatively, made from extruded p.v.c. J. F. Kenure, Ltd., Fagg's Road, Feltham, Middlesex, already make "knitted" luggage nets for the aircraft industry.]

Floor and Wall Tiles

SIR,—We wish to contact manufacturers so as to introduce on the Swiss market laminated floor and wall covering material and wall tiles of vinyl compounds for kitchens, bath-rooms, shops and workshops.

If this offer is of interest to manufacturers we should be glad to hear from your readers.

GEORGES MOSER.
5 Chemin des Bruyeres,
Lausanne,
Switzerland.

Foamed Urea Formaldehyde

SIR,—May we correct a claim in the "Letters to the Editor" page, August issue of *Plastics*, that this material is only manufactured by one firm in this country. We produce foamed urea formaldehyde in sheets, blocks, shapes, mouldings and powder, under the trade name of Norton-Foam, for varying uses, including refrigerator insulation, sound proofing, advertising, decorative effects and imitation snow.

NORTON PLASTICS, LTD.
Heanor Road,
Ilkeston,
Derbyshire.

P.V.C. Sheet

SIR,—Recently we read Press reports regarding a new sheet p.v.c. which "breathes" or in other words it permits ventilation whilst being completely waterproof.

Will you kindly endeavour to put us into contact with the source of supply or preferably the actual maker.

AUDIVISION LIMITED.
P.O. Box 978, 49 High St.,
Auckland,
New Zealand.

Polythene Bottles

SIR,—We anticipate we will be needing some lightweight screw-capped bottles and have seen some which look to be made of polythene (or something similar). We will be most grateful if you can let us have addresses of makers of such items.

GUTHRIE ALLSEBROOK AND CO.
Artesian Works,
Crown Street,
Reading.

Engraving Plastics

SIR,—We are anxious to produce a chart consisting of a number of lines printed or engraved onto clear plastic sheeting—approximate size 12 in. by 12 in.—and being unfamiliar with the plastics industry we wonder if you can help us by naming some manufacturers who cater for this type of work.

STEPHEN AUSTIN AND SONS, LTD.
1 Fore Street,
Hertford,
Hertfordshire.

Colouring Cellulose Nitrate

SIR,—We are one of the big cellulose nitrate spectacle-frame manufacturers in India and manufacture these frames in various colours such as demi amber, verdal, pink, smoke, golden, etc.

We sometimes require to colour these frames of various colours into black and wine colours. We shall therefore feel much obliged if you will kindly suggest to us some method or formula of colouring these frames in this way.

MONTEX CORPORATION.
1st Umerkhadi Road,
Bombay, 9 (India).

Brooches

SIR,—We would like to know if you can advise us of a firm specializing in the making of Perspex brooches with names printed or stamped on. All the names to be different and to our specifications.

BROWNING'S LABORATORY AND SUPPLY CO., LTD.
69 Aberdeen St.,
Hull.

Plastics Buckles

SIR,—Would you kindly supply us with names and addresses of manufacturers of plastics buckles, suitable for belts, etc.

REDLANDS MANUFACTURING CO. LTD.
Maze Street,
Barton Hill,
Bristol, 5.

Plastics in Rocket Construction

SIR,—I think your readers might be interested in some private research work on which I am engaged at the present

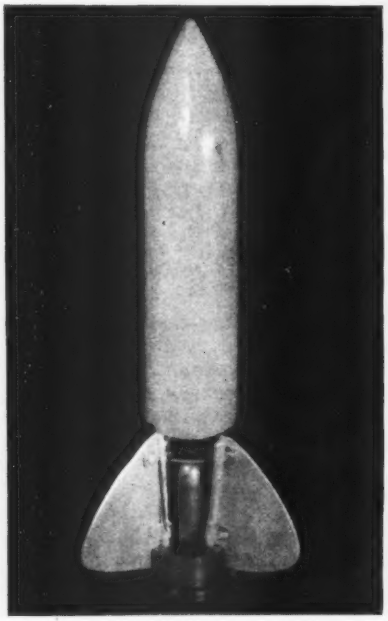
time. The enclosed photographs show the various stages in the construction of a small liquid-fuelled experimental rocket. The main shell of the rocket consists of a glass-fibre polyester resin, low-pressure laminate, which confers considerable strength properties on the complete unit.

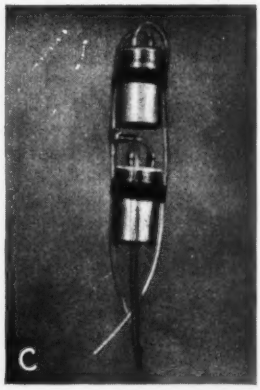
Fuel tanks, inside this shell, are made an integral part of the whole, by the use of a new expanding resin, which I have recently developed. Further, the incorporation of $\frac{7}{8}$-in. chopped strand glass-fibre, in the expanded resin, results in a very strong finished structure. The expanded resin is heat proof, and not only strengthens the outer case, but enables the fuel tanks and pipe lines to withstand much higher pressures. The performance of this, and similarly constructed rockets, is to be discussed at a lecture due to be given to The British Interplanetary Society, early next year, at Leeds.

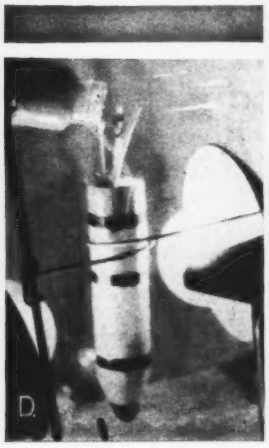
" Fair View," D. N. HUNTER.
Holmfirth,
Nr. Huddersfield, Yorkshire.

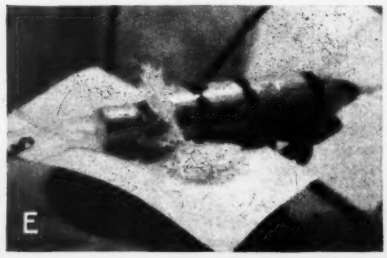
KEY TO PHOTOGRAPHS BELOW

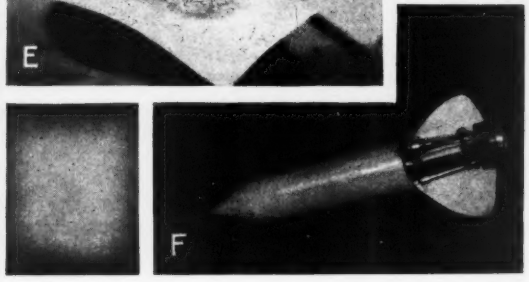
(A) First layer of glass fibre, chopped strand mat, in place on former. (B) Curing the polyester resin by infra-red heating. (C) Fuel tank assembly. (D) Adding the new expanding resin, which foams, and completely fills the interstices. (E) Packing the fuel tanks into place, with $\frac{7}{8}$" chopped strand fibre. (F) The assembled rocket complete with motor and CO_2 cartridge.











EDUCATION OF THE PLASTICS ENGINEER

(*Continued from page* 381)

together with physicists or chemists in the fundamentals of plastics engineering. This programme was designed to fill the needs of industry as we saw them at that time.

Today we have heard the results of a survey by Mr. Bartlett and the paper by Dr. Bloom, both of which give a much clearer picture of the needs of industry. The question now becomes: Does this programme best serve the need as we see it in light of this new data?

I think you will all agree with me that Mr. Bartlett's survey shows that many of the companies polled would like to have engineers with various undergraduate specialities who have been put through a common post-graduate programme in plastics. In our programme we propose two introductory undergraduate courses and five graduate courses. In each case the emphasis is on broad fundamentals, rather than on specific " know how " or procedure. In many cases the course material is of such a fundamental nature that it can be applied to nearly all engineering materials, whether of polymeric nature or not. For example, the subject of rheology as it would be presented in the Properties of Plastics course is of such a fundamental nature that it is equally applicable to many industries. This same subject, when properly presented from the point of view of fundamentals, is of value in nearly all the many facets of the plastics industry.

It has been suggested that colleges and universities should teach only the fundamentals of science and leave all specialization to "on-the-job " training. This sounds very good in principle but neglects some of the facts. First of all, students need some experience and training in the classroom to show them how to apply their knowledge of fundamental science to the problems of various industries. Secondly, our technology has progressed to the state where the fundamental concepts involved in specific industries are so advanced that they are very difficult to grasp without formal training. It is our belief that it is a more efficient process to convey these principles to our young engineer in a classroom rather than making him dig them out by himself when he is on the job. For example, since plastics are used as engineering materials in the electrical insulating field, it is apparent that the producers in this business must have men who can determine the properties of these materials. I am sure you all appreciate how much time and effort would be required for, let us say, an electrical engineer to make himself an expert in this field by " on-the-job " study.

New Productions

Plastics Overshoes

At the recent Shoe and Leather Fair held at Olympia, Frido, Ltd., 8, Great King Street, Macclesfield, showed overshoes made in one piece from clear, transparent vinyl material. The mouldings include soles and heels which are moulded in triple thickness with a non-slip tread. The shoes are supplied in a convenient carrier bag also made of transparent plastic sheeting. This enables the shoes when wet to be carried safely in a handbag. They are made in three sizes suitable for ladies and children and they are sold under the trade name " Rain Tootsies." Fastening is by means of a plastic strip which can be tied.

Picnic Set

An attractive picnic set has been produced by The British Vacuum Flask Co., Ltd., Lissenden Works, Gordon House Road, London, N.W.5. The container for the set consists of two large mouldings made from urea formaldehyde. The two halves of the case are so designed that when fully opened as shown in the illustration the flat outer surfaces form a table top and four folding metal legs may be extended to complete a useful table. The picnic set consists of two Twincup vacuum flasks, four plates, a sandwich box, two screw-top jars and a milk bottle. The plates and the cups of the vacuum flasks are also moulded in plastic materials. The Servapik table is available in a variety of colours including blue, red, green, ivory, yellow and black. The mouldings for the case are produced by The National Switch Factory, Keighley, Yorkshire, which is an associated company of The British Vacuum Flask Co., Ltd.

Water Jet Pumps

The Speedivac plastic water jet pump which was described and illustrated in " New Productions," *Plastics*, September, 1953, was designed and developed by W. Edwards and Co. (London), Ltd. The unit is produced exclusively by this company. The plastics mouldings employed were produced by Crystalate, Ltd.

Deodorant Spray

Flexible bottles blown from polythene have found wide appeal in all forms of packaging where unbreakability, chemical resistance and light weight are desirable. In the cosmetics field the possibility of using the " squeeze bottle " with a spray attachment has also brought new applications. One of the latest productions in this field is the Sno-Mist deodorant container which is produced by Cascelloid, Ltd., Abbey Lane, Leicester, for E. Griffiths Hughes, Ltd., of Manchester. The bottle, which is produced from opaque white polythene, is printed on one side and carries a relief floral design forming an integral part of the container.

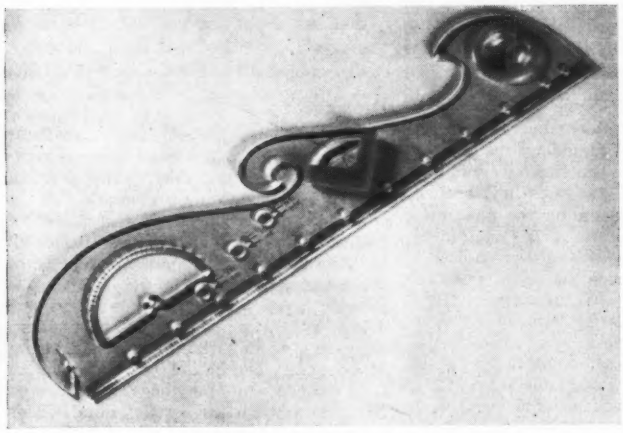
Perspex Scale

A multi-purpose scale intended as an advertising gift to be given away to architects, surveyors and builders, has beeen produced by Ernest and Henry, Ltd., St. Helens Auckland, Bishop Auckland, Co. Durham. The instrument fulfils the function of a scale, spirit level, French curves, protractor and compass, as any radius up to 10½ in. can be drawn by inserting a pencil point through an appropriate hole in the scale. A magnifying

(Above left and centre) Vinyl overshoes.

(Above) Deodorant spray.

(Left) Picnic sets shown in use as table and container.



Multi-purpose scale.

Blanket clip.

lens is also fitted and this versatile instrument has a further use, in that it may be used as a letter balance. For this purpose the letter is inserted in the spring at the end and a pencil is put through the appropriate hole to ascertain the weight. Supplies of this article are obtainable from Messrs. B. C. Young, 6 Melville Street, Edinburgh, 3. Name and address can be stamped on as required.

Blanket Clip

The Simplex blanket clip has been designed to provide an easy method of fixing sheets, blankets, etc., to a baby's cot or perambulator. The three parts of the clip are injection moulded by Mentmore Manufacturing Co., Ltd., Plastics Division, 1 Bradley Road, Wood Green, London, N.22. The material is polystyrene in a variety of pastel colours. The clip is secured to the cot by an extruded p.v.c. strap fastened by a plastic buckle in matching colours.

Polystyrene Toys

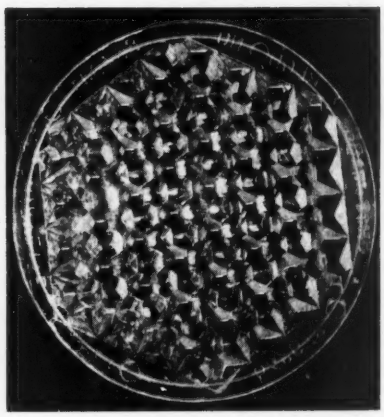
Two toys recently produced by Selcol Products, Ltd., are the Robin Hood outfit, which includes a moulded plastic bow and a pirate's outfit which includes a moulded sword. Both these toys have been injection moulded by Thames Valley Moulders, Ltd., and make good use of the resilient characteristics of certain grades of polystyrene.

Reflectors

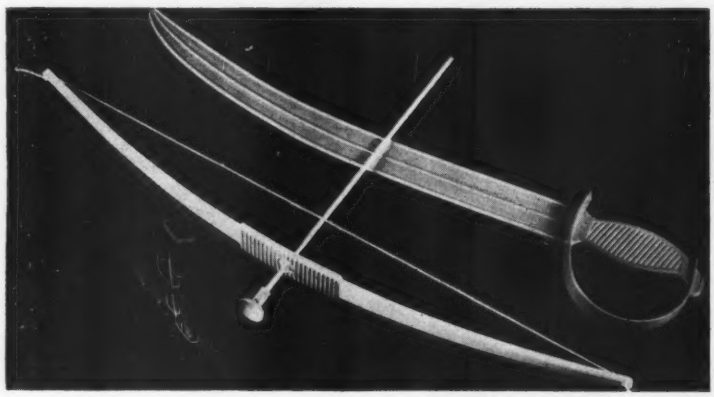
Shown at the Engineering Industries Exhibition in London recently was a 3-in. reflector lens fabricated from polystyrene. Fairylites, Ltd., Manor Hall Road, Southwick, Sussex, have manufactured these reflectors for many years, formerly using glass. The company has recently employed high impact polystyrene manufactured by Monsanto Chemicals, Ltd., with the result that the lens is highly durable and tough. Unlike early high impact materials based on styrene polymers, which were only obtainable in opaque shades, the material from which this lens is moulded has the excellent optical properties required for this application.

Protective Gloves

The use of polyvinyl chloride as a coating material for protective gloves has been developed over many years by James North and Sons, Ltd., Godley Mills, Hyde, Cheshire, and an article on the production of this type of protective glove appeared in *Plastics*, May, 1951, page 115. The latest type of glove to be produced by this company is a cotton glove coated on the palm side only and having an uncoated fabric back. For many jobs in which protection of the palm from chemical or mechanical hazards is sufficient, this type of glove has the advantage of providing improved ventilation, thus making it cooler to wear and permitting it to be worn for longer periods without discomfort. The glove has been proved to have superior wearing properties to the leather palm (cotton backed) and general leather gloves. There are two grades, one having a smooth finish palm coating for light duty jobs and the other a rough finish palm coating for heavy duty jobs where stronger grip is required.



Reflector lens.



Polystyrene toy bow and sword.

Protective gloves.

Plastics NEWS

Raw Materials, New Plant, Works Organization, Control Apparatus, Research, Personal and Trade Notes

NEW EXTENSION TO THE SIGMA WORKS.—In 1920, when Dr. A. J. Stewart started to manufacture a range of scientific instruments specially suited to the gas industries, there began the development of a concern which has steadily grown in status and in size and to which a significant tribute was paid by Mr. F. H. Rolt, O.B.E., at the recent opening of the new extension to the Sigma Instrument Company works at Letchworth. Mr. Rolt, one of the world's foremost experts on measuring equipment, drew attention in the course of his speech to the predicament in which Great Britain was placed in 1939 by virtue of the little work that had been done in the field of measuring equipment.

The remarkable increase in size of the company has been largely due to Mr. J. Loxham, the managing director, and to the acquisition of the company by Alfred Herbert, Ltd., of Coventry. The technical and commercial experience of the two firms has brought to the engineering industry new and important developments in the art of measurement and inspection; this, coupled with the extensive research of Mr. Loxham, has been responsible for the development of inspection machines and equipment of a remarkably high order. To name only a few, there is the range of Sigma automatic multi-dimension inspection machines, the Sigma method of quality control, the recorder for specific gravity, the water flow calorimeter, and the complete range of comparators which embrace electrical, optical, pneumatic and mechanical measuring instruments.

The new extension will enable production to be greatly increased and should have a considerable influence on the reduction of inspection costs in plants throughout the country. By the installation of correct controls both in the automatic field and points of production, engineers are now able to get the most out of their machines and thus substantially reduce the quantity of rejects during the inspection stage.

Mr. Loxham and his staff are to be congratulated upon achieving in a very short space of time the phenomenal increase in output and, what is more important, placing this country in the foreground of the measuring instrument field.

OMNIA INFINITELY VARIABLE GEARBOXES.—Bourdon Tools, Ltd., sole selling agents in the U.K., have sent us details of the Omnia gearbox manufactured by Buhrs and Zonen, of Zaandam, Holland. Model 025-1 with a ratio of 1 : 25, when powered by a 1 h.p., 1,425 r.p.m., motor, gives a range of output speeds that is infinitely variable between 90-2,544 r.p.m., a remarkable output for such a small unit. Demonstrations can be given at the works or offices of prospective customers and further details can be obtained from the agents at Union Road, Croydon.

TURNER MANUFACTURING CO., LTD.—Two new appointments have been announced by the company. Mr. J. D. Greenway, C.M.G., has been appointed overseas envoy, having previously served as H.M. Minister in Panama and Iceland. Mr. R. L. Beverley, D.F.C., has taken up his new position as Home Sales Manager, Diesel Sales, and has had extensive sales experience with the motor industry.

MR. V. G. BURCHILL has joined the central publicity department of the General Electric Co., Ltd. Amongst his responsibilities will be publicity for the Witton Moulded Insulation Works.

THE DISTILLERS COMPANY, LTD.—Mr. G. H. Duncan and Mr. E. J. Farrar have been appointed to the board of directors of Commercial Solvents (Great Britain), Ltd.

SERVICE ENGINEER RETURNS FOR REFRESHER COURSE.—Mr. W. Bailey, who was originally trained by R. H. Windsor, Ltd., before going out to Canada, where he has been for a number of years, has returned to this country for a refresher course at the company's works at Chessington, Surrey. Mr. Bailey is resident service engineer in Toronto for R. H. Windsor, Ltd.

(Left) View of part of extension to the Sigma works at Letchworth, Herts.

CHEMICALS FROM PETROLEUM.—We are informed that work will soon commence on the first plant in Western Germany to produce polyethylene and ethyl benzene from oil. The operators of this venture will be "Rheinische Olefinwerke G.m.b.H." and the polyethylene is to be produced at Wesseling under the registered trade mark Lupolen.

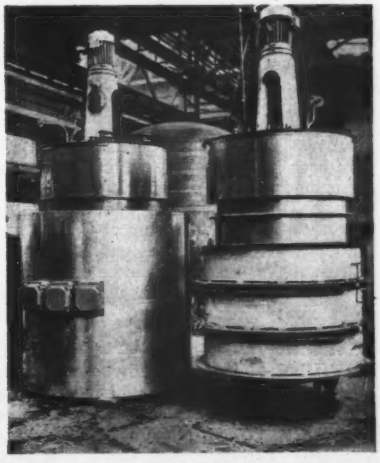
TERYLENE FOR WESTERN GERMANY.—Imperial Chemical Industries, Ltd., have licensed two companies to produce Terylene. They are Farbwerks Hoechst A.G., of Frankfurt, and Vereinigte Glanzstoff-Fabriken A.G., of Wuppertal-Elberfeld. Western Germany thus becomes the third European country to take up this British synthetic fibre.

CALCIUM CARBIDE.—British Industrial Solvents, a division of The Distillers Co., Ltd., has taken a lease of the Ministry of Supply Kenfig calcium carbide factory as from October 1, 1953, and from that date will be responsible for the production and distribution of this material.

VINYL PRODUCTS, LTD., announce extensive price reductions in their range of Vinamul emulsions based on polyvinyl acetate and polymethacrylate resins, and many of the Vinalac polymer solutions. These become operative for all deliveries from December 2 and are made as a result of larger polymerization plant at Carshalton.

CELLOGLAS, LTD., announce that owing to a change of ownership the company's office is now established at 50 Brook Street, London, W.1, to which all communications should be sent.

COMMERCIAL PLASTICS, LTD., announce that their new address is 1 Avery Row, Grosvenor Street, London, W.1, telephone HYDe Park 9261.



(Right) Two resin kettles heated by the Kirberg system.

INDUCTION HEATING FOR RESIN PLANT.—Carl Canzler (London), Ltd., 47 Victoria Street, London, S.W.1, have sent us a photograph of two resin kettles heated by the Kirberg system (*Plastics*, January, 1953, pages 21 and 22). These kettles are of 2,000 litres capacity each, manufactured in mild steel with stainless steel linings. The blade stirrers are powered by sealed motors. Induction heating at low frequencies and standard voltages gives a working temperature of up to 300° C. These two kettles have already been installed in this country.

Ashdowns prize-winning stand.

PURCHASING OFFICERS' ASSOCIATION.—The fourth annual Minibition, held at Brighton in connection with the 1953 conference, included a competition by means of which members selected the three best displays. One of the winners was Ashdowns, Ltd., whose display showed the activities of the company in the fields of thermosetting, thermoplastic materials, paper mouldings, fibreglass and laminates.

PLASTICS INSTITUTE ASSOCIATESHIP EXAMINATION.—The following candidates were successful in the examination held in June: E. Ball, A. Crowther, N. A. Gardiner, T. Jacques, P. G. Mellor, of Newton Heath Technical College; G. H. Bowler, J. O. Crane, D. C. Snow, D. N. Sud, of Acton Technical College; W. Heller, R. B. Mumford, of National College of Rubber Technology and J. R. Robertson, of Royal Technical College, Glasgow.

NEW LECTURE COURSE.—Details have been announced of a series of lectures on methods of non-destructive testing being held on Tuesday evenings from 7-9 p.m. at the South-East Essex Technical College and School of Art, Longbridge Road, Dagenham. Full details of the subjects to be covered are obtainable from the Head of the Department of Physics and Mathematics.

SMALL INJECTION MOULDING MACHINE.—In the April issue of *Plastics* we described the small hand-operated injection moulding machine produced by The Small Power Machine Co. Ltd., 4 Sunleigh Parade, Alperton, Wembley, Middlesex. At the recent International Handicrafts Exhibition this company showed for the first time a larger and improved model including features such as semi-automatic hopper feed, heat control by rheostat and a temperature indicator. The moulds, which can be up to 3 in. by 2¾ in. by 1½ in., are held locked by a quick release vice. The manufacturers can provide stock moulds or make moulds to order. The capacity of the machine is ⅛ oz., and the maximum pressure obtainable is 5,000 p.s.i. The power consumption is 180 watts.

ASSOCIATION OF PLASTIC CABLE MAKERS.—18 firms have combined to form an association with a view to promoting the interests of the industry and establishing standards of quality for plastics cables. Full information can be obtained from the Secretaries, James Edwards and Co., 381 Salisbury House, London Wall, London, E.C.2.

A. SCHULMAN INC., of Akron, Ohio, U.S.A., recently celebrated its twenty-fifth anniversary. Established primarily to serve reclaim plants, the company is now not only a major supplier for reclaimers, but an importer and dealer in crude rubber, and a processor and dealer in hard rubber (ebonite) dust, plastics and foam rubber. As a need for expansion presented itself in recent years, A. Schulman opened offices and warehouses in London, at Ibex House, Minories, E.C.3, and in Hanover, Germany, and set up agents in Japan, Spain, Ireland, India and several South American countries. Directing the London operations as general manager is Mr. L. W. Bottomley, whilst Mr. J. E. Helyer is manager of the plastics department for the United Kingdom.

NEW REPORTS ON GERMAN DEVELOPMENTS.—Translations of a large number of recent German patent applications in the field of synthetic resins are now available from the Research Information Service, 53 Nassau Street, New York. As an example may be quoted "Process for Producing Condensates of Polyamides." This deals with a product which is claimed to have increased resistance to heat, cold and water as well as improved flexibility. The process involves a condensation technique with certain compounds.

PLASTICS CONFERENCE IN SWEDEN.—On November 19 and 20 the Swedish Plastics Federation will be holding a Conference during the course of which several papers will be read by prominent members of the British and American plastics industries. Amongst the speakers will be, Mr. M. Jones, I.C.I. Ltd., Dr. M. A. Matthews, Shell Petroleum Co., Ltd., Mr. D. S. Mahon, Bakelite Ltd., Mr. S. D. Eagleton, Monsanto Chemicals Ltd., Mr. J. Butler, British Industrial Plastics Ltd., and Mr. C. W. Welch, Assistant Editor, *Plastics*. The conference will be held in Stockholm.

GOLF.—During the meeting at Moor Park on October 6 the results were as follows:—**Artid Trophy** (Medal) Winner: J. G. Selby (Insulators Ltd.) (24), 73 net. Runner-up: P. L. W. Morton (Temple Press Ltd.) (18), 75 net. **British Xylonite Trophy** (Stableford Bogey Singles), Winner: P. T. Fletcher (Hercules Powder Co. Ltd.) (10), 33¾ pt. Runner-up: P. C. Chaumeton (Erinoid Ltd.) (11), 32⅝ pt.

UNPUBLISHED REPORTS.—The Technical Information and Document Unit of the D.S.I.R., 16 Regent Street, London, S.W.1, has circulated a further list of reports which are available from various sources. Amongst the subjects mentioned is a review of shell moulding patents and recent technical literature relating thereto. The report comprises 13 pages and the serial number is PB.106640.S.

MR. MARTIN APLEY has left Catalin, Ltd., to join the Walker Extract and Chemical Co., Ltd., of Bolton, Lancs, as Development Manager and Director. Mr. Apley has been chief chemist of Catalin, Ltd., since its formation in 1937. He is a member of the Council of the Plastics Institute and a Past Chairman of the London Section.

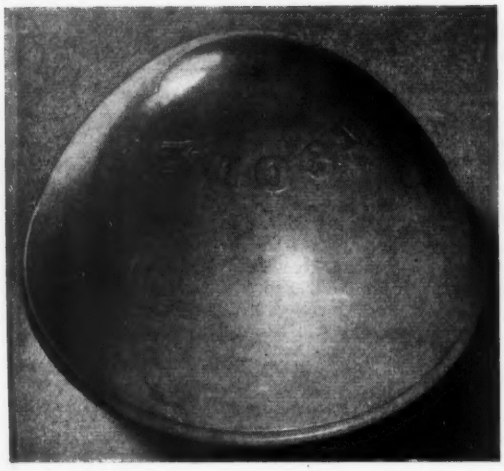
PLASTICS AND METALS.—A new company has been formed for the fabrication of metal components and the production of plastics units for industrial purposes. Accessories for the electronics field are amongst the company's productions. The offices of the new company, Plasmetics Ltd., are at 42 St. Martin's Lane, London, W.C.2.

SWISS COMPANY'S NEW AGENTS IN BRITAIN.—Wickman, Ltd., have been appointed the sole agents for the Swiss machine tool manufacturers Edouard Dubied et Cie, Neuchatel, Switzerland. The manufacturing programme at present comprises rapid copying lathes, high production lathes and universal tool and cutter grinding machines.

DISTILLERS COMPANY LIMITED.—The telephone number of Mr. A. F. B. Neal, Publicity Department, is now changed to Temple Bar 0325.

REINFORCED PLASTIC BOATS.—We have received from the Plastic Research Institute, Delft, Holland, details of work now being carried out by the shipbuilding concern "Paturi Glasboot" at Warmond, Holland. Following two years of intensive research the yard has succeeded in building a sailing yacht 16 ft. long with a beam of 5¾ ft. The deck and hull were manufactured from glass fibre yielding a craft which is over one hundredweight lighter in weight than a similar construction of wood. Sailing tests carried out indicate that the vessel is faster than a wooden counterpart. We understand that the yard is now expanding its work to include the construction of glass fibre lifeboats.

The photograph shows the elegant lines of this glass fibre/resin bonded yacht.



A recent issue of "India-Rubber Journal" referred to experimental work in Holland on the manufacture of plastics cups for the collection of latex on rubber plantations. Aluminium cups are apparently popular with plantation workers and are used as domestic utensils. The illustration shows a cup which was being manufactured on a pilot plant scale some time ago at the Goodyear Laboratories at Akron, U.S.A.

B.I.F. 1954.—Information from the Board of Trade indicates that one of the biggest campaigns ever is about to open up to bring in new companies to next year's B.I.F. Three times as many firms are being invited to take part in the London section than have ever been approached before and this is backed by a vigorous advertising campaign. As a result of a radical change in policy prospective exhibitors can now buy space from plans. This means that an exhibitors position can be pre-selected by him as distinct from the procedure previously in operation whereby he requested the requisite amount of floor space, the exact location of which was left to the organizers.

EPIKOTE RESINS.—Following the recent announcement by Shell Chemicals, Ltd., of the ready availability of Epikote resins from a non-dollar source, the company has now published a new booklet on the properties and applications of these resins. Entitled "Epikote Resins for Surface Coatings," it contains 45 pages of useful information. Copies can be obtained from the company at Norman House, 105-109 Strand, London, W.C.2.

THE MICANITE AND INSULATORS CO., LTD.—We have received copies of three new technical publications, one dealing with Mica and Micanite, one on the subject of electrical insulation, and a general review of the range of products of The Micanite and Insulators Company. Copies are obtainable from the company, at Empire Works, Blackhorse Lane, Walthamstow, London, E.17.

MARKING CONTAINERS. — An important book has just been published by the Association of British Chemical Manufacturers, 160 Piccadilly, London, W.1, and constitutes a system for warning labels for containers of hazardous chemicals. Specimen wording is given for labels for a first list of over 200 chemicals and copies can be obtained from the Association, price 7s. 6d.

MACHINERY CATALOGUE.—George Cohen have published the first post-war catalogue of machinery and equipment for sale by the company. The catalogue embraces new and second-hand plant and includes an index. Comprising 212 pages, the catalogue is a welcome return to a valuable pre-war service.

INSTALLING LAMINATED PLASTICS.—Copies of a new publication published by Warerite are available from the London office, 12-16 Grosvenor Gardens, London, S.W.1. The booklet, well illustrated, describes the application of Warerite veneered boards and panels to wall linings, fitments and furniture. Sectional drawings are given to demonstrate suggested techniques. The booklet contains notes on various methods of fabricating, including drilling, jig-sawing, routing, and edge finishing.

ALDEHYDES is the title of a new publication by Carbide and Chemicals Company, a division of the Union Carbide and Carbon Corporation. 36 pages long and excellently printed, the booklet has been prepared as a handy reference for chemists, engineers, production and laboratory workers. Tabular information is given on uses and suggested applications of the 14 aldehydes made by the company, physical properties are scheduled, testing methods are described and a list of selected references to aldehydes in the technical literature are included. Copies are available from the company, at 30 East 42nd Street, New York, 17, New York.

PRODUCTIVITY REPORT ON PRODUCTION CONTROL.—The team of specialists who spent six weeks in the U.S. in 1951 have compiled their report, including a list of noteworthy recommendations. The team is of the opinion that the methods used in the States had contributed in no small measure to the high level of productivity and now recommends that British industry should examine its present system of production planning and control in the light of the information which the team has brought back from America. Comprising 130 pages, the report offers valuable information in most fields of production planning; it is extremely well illustrated with documents in common use in U.S. industry. Copies are available from the British Productivity Council, 21 Tothill Street, London, S.W.1, price 5s.

MEETINGS

November

3.—"Fibres of Yesterday and Tomorrow," Professor J. B. Speakman, D.Sc., F.R.I.C., F.T.I., Professor of Textile Industries, Leeds University. Annual Institute Lecture, Plastics Institute, Midlands Section, Birmingham College of Technology, Suffolk Street.

11.—Film Show—Science Behind the Car—Fine Tableware in the Making—P.V.C. Plastics Institute, South Wales and Monmouthshire Section, Cardiff Technical College. 7.0 p.m.

12.—Luncheon. Plastics Institute, London Section. Criterion Restaurant, London, W.1.

16.—"Product Design," A. H. Woodfull, M.S.I.A. Plastics Institute, London Section, Waldorf Hotel, Aldwych, London, W.C.2. 6.30.

18.—"The Method of Drawing and Die Design," R. Smith, Brook Motors, Ltd. Plastics Institute, Yorkshire Section, St. Mark's House, 186 Woodhouse Lane, Leeds 2. 7.0 p.m.

18.—"Applications of Motion Study," Miss Anne G. Shaw, M.A., M.I.P.E. Plastics Institute, Western Section, Bell Hotel, Gloucester. Joint meeting with the Gloucester Sub-section of the Institution of Production Engineers.

18.—"Krilium," Monsanto Chemicals, Ltd. Plastics Institute, North-Eastern Section, Neville Hall, Newcastle upon Tyne. 7.0 p.m.

18.—Discussion Meeting. Plastics Institute, Scottish Section, St. Enoch Hotel, Glasgow. 7.30 p.m.

19.—"Structural Plastics for Aircraft Use, in Theory and Practice," L. N. Phillips. Plastics Institute, Southern Section, Portsmouth Municipal College. 7.30 p.m.

20.—"Financial Management Through Costing and Budgetary Control," H. Senior, M.Sc.(Econ.), B. Com., A.C.A., British Xylonite Co., Ltd., Cascelloid Division. Plastics Institute, Midlands Section, Birmingham.

25.—"Vinyl Emulsion Polymers and their use in Coatings," C. E. Hollis and J. H. W. Turner. Society of Chemical Industry, Plastics and Polymer Group, Royal Society of Tropical Medicine and Hygiene, Manson House, 26 Portland Place, London, W.1. By invitation of London Section, Oil and Colour Chemists' Association.

27.—"Importance of Plastics to the Housewife," Ladies Evening, preceded by three talks, "Thermosettings" J. B. Haughton, "Thermoplastics" J. Kenyon, "Colour" C. Musgrave. Plastics Institute, North-Western Section, Engineers' Club, Albert Square, Manchester.

27.—Dinner Dance. Plastics Institute, South Wales and Monmouthshire Section, Angel Hotel, Cardiff.

December

3.—"Patent Law," Dr. M. Brent. Plastics Institute, Southern Section, Polygon Hotel, Southampton. (Joint Meeting with I.R.I.) 7.30 p.m.

4.—Third Annual Dinner Dance, Plastics Institute, Western Section. Queen's Hotel, Cheltenham, 8.0 p.m.

9.—"Characteristics and Manufacture of Glass Fibre Reinforced Laminates," C. Joseph, Ashdowns, Ltd. Plastics Institute, Yorkshire Section, St. Mark's House, 186 Woodhouse Lane, Leeds, 2. 7.30 p.m.

9 and 10.—Film meeting, Plastics Institute, London Section. Film House, Wardour Street, London, W.1. 6.30 p.m.

TALKING SHOP . . .

Searching for the News. One of the most difficult tasks of the technical journalist is to condense the news items which pour into the editorial offices and to present them in a form compatible with the restricted space available in the journal. He fights an uphill battle in an effort to say all that should be said and at the same time to print all that is really "news." There is a clear-cut distinction, however, between the news that concerns personalities and companies and technical information which is so voluminous as to defeat even the most ingenious précis writer. Hence the brief notes that appear in the pages of *Plastics* in such columns as "World's Industry Employs Plastics", "Plastics News", "Talking Shop" and "Patent Review."

However, there is much information which can be had for the asking and one such fruitful source is the Technical Information and Documents Unit of the Department of Scientific and Industrial Research at 15 Regent Street, London, S.W.1. On page 392 of this month's issue of *Plastics* is an extract from one of the unpublished reports, many of which emanate from the U.S. These reports bring to light many interesting technical developments and regular notification of their availability can be sent by arrangement to companies and individuals. All that the reader need do is to advise the T.I.D.U. that he would like to be made aware of reports on or related to plastics.

Another service, from the same organization, concerns details of important American technical articles. Formerly issued in Britain by the Mutual Security Agency of the American Embassy, the service has now been taken over by the T.I.D.U. Detailed abstracts are prepared in Washington and subsequently transmitted to London, and any reader of *Plastics* can, by stating his field of interest to the T.I.D.U., obtain regular details of American development in plastics.

Much of the information that is available is free: during the course of the year there are bound to be one or more items of interest to practically every member of the plastics industry in this country; hence the importance of taking full advantage of the services described above.

* * *

A Letter to the Editor. In these days of high-pressure business, the average man has little time for anything but essentials. And we have found that one of the "essentials" to many of our readers is the "Letters to the Editor" page.

Letters range from the technical exposition of a serious industrial problem to an inquiry for plastic buckles. They are equally important in that they reflect what readers are thinking or wanting, and many instances can be recorded of new business contacts being formed by a manufacturer in this country seeing an inquiry in *Plastics* from home or abroad which he can convert into a firm order. Again, many interesting commentaries on purely technical matters have found their way into print merely because someone has had the urge to write to the editor of a technical journal.

On commercial grounds, therefore, as well as from the point of view of general interest, there are good reasons why the man with something to say should take up his pen and address himself to the editor. The readers of *Plastics* are invited to make full use of the one page in the journal which is set aside for their contributions. By so doing they will not only enjoy the gratification(?) of seeing their handiwork in print; they will on most occasions help themselves and others.

* * *

More car bodies. As expected, the announcement of plastics cars at the Motor Show last month (a report appears on page 369) coming shortly after the controversy over metal body supplies between Jowett Cars and Briggs Bodies, aroused much enthusiasm in the Press. The most informative article on the subject, however, appeared in the Birmingham Gazette nearly three weeks before the Earls Court Show opened. Ronald Wilcox giving the non-technical reader a clear idea of the advantages to be derived from plastics body construction describes work carried out by Jensen Motors, Ltd., in collaboration with British Industrial Plastics, Ltd. He also describes the work of Mr. Richard Shattock, of R.G.S. Automobile Components, Ltd., Winkfield, near Windsor. This company has already produced about 20 complete plastic car bodies, of which three went to Canada and one to U.S.A. The components are moulded by North East Coast Yacht Building and Engineering Co., Ltd.

* * *

Plastics Cable Makers. The formation of a Plastics Cable Makers Association is announced on page 392. This news was first given in the *Electrical Times*, which credits Mr. L. S. Hargreaves, chairman and managing director of Aerialite, Ltd., with much of the work which created the Association. A technical sub-committee has been formed to consider standards of safety and quality.

The executive committee comprises Messrs. Townsend, Associated Technical Manufacturers, Ltd., who is vice-chairman; S. Day, J. Day and Co. (Derby Works), Ltd.; J. Entwistle, Mersey Cable Works, Ltd.; and C. Morriss, Rists' Wires and Cables, Ltd.

Other member firms are: Armorduct Cable Co., Ltd.; British Driver-Harris Co., Ltd.; Duratube and Wire, Ltd.; General Cable Manufacturing Co., Ltd.; William Geipel, Ltd.; L.P.S. Electrical Co., Ltd.; Plasticable, Ltd.; Ripaults, Ltd.; Sterling Cable Co., Ltd.; Britannic Electric Cable and Construction Co., Ltd.; Concordia Electric Wire and Cable Co., Ltd.; Suflex, Ltd.; and Tenaplas (Sales), Ltd.

* * *

Handicrafts. Evidence of the success of the sales campaigns for Warerite and for Formica decorative laminates were the large crowds surrounding the stands showing these laminates at the International Handicrafts Exhibition. The idea of selling decorative laminates in small sizes suitable for the home is a fairly new one and has become very popular. Both companies supply instructions enabling the average home handyman to renovate his own table.

* * *

There is nothing like leather. Of the many trade exhibitions to be visited during the year, the Shoe and Leather Fair at Olympia does not arouse my greatest enthusiasm. The only compensation for the rather cold atmosphere created by the closed-box type stands are the beautifully produced catalogue and the delightful smell of newly tanned hide. However successful the plastics chemist may be in simulating the appearance of leather and improving on its properties, there is still a long way to go between the smell of d.o.p., t.c.p. and the rest of the plasticizers and the smell of new leather.

The controversy as to the suitability of the resin/rubber type of soling material is still greatly in evidence, but the very long wear obtainable from these materials is undisputed. On the question of "breathing" one manufacturer commented: "To make a water-resistant leather sole, you impregnate with wax. Where is your 'breathing' then?" Dunlop's are the most recent arrivals in this field with their new soling material. The only plastics manufacturing company at the Fair was Arlington Plastics Development, Ltd., which produced a beautiful range of cotton-backed p.v.c. materials for the shoe trade. In addition they now produce a paper-backed p.v.c. socking. Arlington have realized the damage to sales appeal of some of the more pungent plasticizers and are actively experimenting with odour masking agents.

* * *

Plastics for Edinburgh School Construction. Plans have been approved for the construction of a new primary school with accommodation for 650 children in the Drylaw district of Edinburgh. Use of cellular plastics panels less than 2 in. thick was suggested by the architects George L. Walls and Duncan, to save building materials urgently required for housing. The panels (from reports these appear to be of the Holoplast type) are supported on a reinforced concrete raft. They are pre-cut and fitted with doors and windows before being brought to the site where only joining of adjacent panels by means of aluminium extrusions is required. Heat insulation in this wall is provided by filling the intercellular spaces of the panels with glass wool. The heat retaining properties of the structure are important since electric heating is to be restricted to off-peak hours and the accumulated heat dispersed during the day. The school is estimated to cost £100,000. It is said to be the first time in Britain that a building of this experimental type has been carried out on such a large scale. A second school using the same methods of construction is proposed for the Hyrot's Bank district of Edinburgh.

* * *

Tubing for Canada. A four-thousand-foot length of Armourvin reinforced p.v.c. tubing recently exported to Canada by Creators, Ltd., West Byfleet, Surrey, is claimed to be the longest single length of reinforced pipe made in one piece.

PLASTIKON.

COPOLYMERS

Part I

A review of some important materials capable of copolymerization, with extensive technical literature and patent references.

The Formulation of Thermoplastic Materials by Copolymerization

By A. E. LEVER, A.I.R.I.

COPOLYMERIZATION has been defined[1] as the submission of a mixture of different monomers to any conditions which result in polymeric products.

Machionna[2] states that interpolymerization may be defined as the incorporation of units of different types into one individual unit, or, to be more specific, it is the copolymerization of two or more unsaturated compounds to form polymers consisting of alternating dissimilar monomers, which differ in physical and chemical characteristics and behaviour from a mixture of the same dissimilar compounds polymerized separately and admixed physically.

There is an interesting series of papers[3] of which one, by J. McNabb, deals with the definition and theory of copolymerization. He defines copolymerization as the method of combining two or more unlike unsaturated organic molecules or monomers to form a chain polymer by addition. If one or more of the monomers is not capable of polymerization alone, the resulting copolymer is usually referred to as a heteropolymer, e.g. the copolymerization of styrene and maleic anhydride.

Ritchie[4] considers that a polymer is a product in which the macromolecule is built up from two or more different repeating monomer units. A further development of the term polymerization has been its extension to various condensation reactions, e.g. the 2.2 esterfication of a dibasic acid and a dihydric alcohol. It has been customary to include in the term polymerization reactions proceeding not only by poly-addition but also by poly-condensation.

For those interested in the theory of copolymerization, a book by Alfrey and others[5] should be consulted, and it is pertinent to note that they consider that scientific and industrial interest in the field of macromolecules is shifting increasingly from polymers to copolymers, from polymerization to copolymerization.

The literature during the past few years has given evidence of the vast number of monomers which have been tried with a view to forming copolymers for various applications. However, it will be readily understood that many of them have proved to be of academic interest only, and it is intended to review only those copolymers that have attained, or are likely to attain, commercial importance.

No apology should be necessary for including in a publication dealing primarily with plastics many details regarding synthetic rubbers. Barron[6] rightly points out that rubber manufacturers using synthetics have been accustomed to handling plastics, and, it may be added, with an increasing interest, e.g. butadiene-acrylonitrile rubbers as plasticizers for polyvinyl chloride, high styrene resins with natural and synthetic rubber for shoe soling and other applications.

Copolymerization may be carried out as an emulsion or in solution, and whichever method is used, it has a profound influence on the properties of the final product. Most copolymers today are made by the emulsion technique.

It is not easy to classify the various copolymers but the method adopted here will be to group the various products under the class denoted by the major constituent of the copolymer, e.g., GR-S, which is a butadiene-styrene copolymer with the major percentage consisting of butadiene, will be grouped under butadiene. Those copolymers composed of a major percentage of styrene and known as "high styrene" copolymers, will be grouped under styrene.

Quite obviously, it must be appreciated that the literature is so vast that only a few of the more important references can be given in a review of this nature. Those interested, however, will find that the references given, in many cases, will include other references for a more extensive search if so desired.

The main groups are as follows: 1. Butadiene. 2. Vinyl chloride. 3. Styrene. 4. Acrylonitrile. 5. Drying oils. 6. Polyesters. 7. Acrylic esters. 8. Isobutylene. 9. Sundries.

1. Butadiene

(a) General

Prior to 1939 most of the synthetic rubbers of the butadiene type were produced in Germany either as butadiene-styrene (Buna S) or butadiene-acrylonitrile (Perbunan) copolymers. Several reviews of German literature from 1939-1945 have been published[7] and Machionna's book[2] is very comprehensive, dealing with butadiene copolymers. Numerous references are given, mainly of the patent literature, up to about 1942. The use of synthetic rubber, as is well known, arose from war demands during the First World War and then, at an increasing rate during the Second World War, particularly after the loss of Malaya and the Dutch East Indies, when a decision was taken to manufacture in the U.S.A. a type of butadiene-styrene rubber similar to the German Buna S.

Only one standard tyre of GR-S (Government Rubber-Standard) was allowed to be made until late 1944. Since then modifications have become available with improved processing and other properties.

(b) Butadiene-styrene

For a survey of the technical knowledge of GR-S during and immediately after the war, the GR-S Manual, published by Imperial Chemical Industries, Ltd., in 1947, is excellent in scope and subject matter. Buna S and GR-S are basically similar except that the latter is substantially soluble in benzene, but the former is of a much higher molecular weight and is not so soluble, containing a substantial amount of gel. It must be heat softened before it can be compounded. The name Buna is derived from *Bu*tadiene, and *Na* (sodium), which was used as a catalyst.

These copolymers are normally polymerized at about 40-50° C. with a styrene content of 20-25%, but a type known as "cold" rubber is now being produced which is polymerized at lower temperatures (around 0° C.) and which has a more regular structure than normal GR-S, and gives vulcanizates with greater tensile strength, abrasion resistance, and resilience. All types require carbon black for reinforcement, though some clays and silicates confer some reinforcement. "Cold" rubbers are more conducive to efficient reaction with carbon blacks, hence the greater tensile strength, etc.[8] The qualities of the final product can be varied by using different types of black. Furnace blacks are used extensively.

Morris and others[9] show that less combined styrene (9-16%) than is usual with Standard GR-S results in a copolymer with improved low-temperature properties. Morris and Hollister[10] have investigated suitable plasticizers for gaskets to be used under arctic conditions. All types of these copolymers are compatible with natural rubber.

A Mooney viscosity number is usually quoted for the various grades and this indicates the thermoplasticity of that grade. A high number indicates low plasticity (increased toughness) and is rather difficult to process.

A new technique has been recently developed, called "oil master batching," which makes it possible to use those copolymers which previously were considered too difficult to use. Dinsmore[8] deals very fully with this technique, and it is interesting to note that tyre tread compounded with oil master batched polymers show less build-up in static charge than tyre treads compounded with "cold" rubber, and the wear is substantially better (see also[11]).

Processing is similar to natural rubber but with one or two important exceptions, e.g. less breakdown is necessary on the mixer, and cool mixing machines are essential.

Alfin catalysts[12, 13, 8] have been shown to offer a new method of producing a very tough copolymer with some properties superior to Standard GR-S. In addition, the oil master batch method enables such rubbers to be blended with sufficient plasticizer to render it processable. These Alfin copolymers give vulcanizates of greater tensile strength and abrasion resistance.[14] GR-S copolymers have been used alone or with natural rubber for tyres, mechanicals, footwear, cable, hose, etc.

GR-S combined with a high-styrene resin is used for football helmets. A new moulding technique is used in their manufacture in that the helmet is first moulded and vulcanized and then it is reheated to 200° F. and moulded to its final shape in a cold mould at 15 p.s.i. GR-S60 is a butadiene-styrene copolymer with a small percentage of divinylbenzene.

Reduced styrene content, and polymerization at a lower temperature than normal, is beneficial in a copolymer tested for the manufacture of gaskets for low-temperature service.[15, 90]

A number of butadiene-styrene copolymers are offered in the form of latices for coatings, paints, etc.

Four main types are:—

Table 1

	I	III	IV	VI
Butadiene %	76.5	54	50	55
Styrene %	23.5	46	50	45
Solids %	26–28	37–39	39–45	63
Anti-oxidant %	1.25	Nil	Nil	Nil
Average particle size μ	0.06	0.10	0.20	0.20

These latices differ from natural rubber latex in that: (a) Tensile properties are lower in GR-S. (b) Emulsifiers are present in GR-S latices which are, or may be, thrown out of solution when ZnO or metallic salts are present. (c) GR-S latices require about twice as much sulphur and accelerator as natural rubber latex for vulcanization. (d) GR-S latices do not penetrate fabrics so well as natural rubber latex.

Nevertheless, all types of GR-S latices find considerable use for rug backing, paper saturation, adhesives, etc. Ryden and others[16] have examined the use of these latices for exterior water paints. The paper concludes with a good bibliography. Various copolymers of butadiene-styrene have been suggested[17] for application to wool to prevent shrinkage. Data is given showing that the best results are obtained when the percentage of styrene does not exceed 30%. Good results were also obtained from a butadiene-dimethyl styrene copolymer (up to 40% styrene).[18]

Trade Names for Butadiene-styrene Copolymers

Buna S.-83, etc.	Chemigum.
GR-S—GR-S10, etc.	Hycar O.S.
Butaprene S.	Polysar S.
Philprene.	Krylene.

(c) Butadiene-acrylonitrile copolymers

Polyacrylonitrile itself is difficult to mould[19] but products with good moulding properties can be made by copolymerizing acrylonitrile with various other monomers, such as butadiene.

The most important characteristics of vulcanizates of these copolymers are high resistance to the swelling action of aromatic solvents, oils and greases, good heat and light ageing and therefore particularly useful for oil seals, machine mountings, pump fittings, adhesives, hose, protective clothing, printer's blanket, conveyor belting.

As the nitrile content increases the oil resistance improves, and with lower nitrile content, the low-temperature resistance and hysteresis properties improve and resilience increases.[20]

Nitrile rubbers are tougher and less plastic than GR-S or natural rubber, and therefore require softeners to improve mixing and processing, depending on the end use of the product. Methods of compounding are to be found throughout the literature, and in particular[2, 6, 19, 21, 22]. Clark and Dennis[23] have investigated the compounding of nitrile rubbers for low-temperature flexibility and conclude *inter alia* that the higher the carbon black content, the greater the hardness and the poorer the low-temperature flexibility. Carbon blacks of fine particle size produced increased stiffening at low temperatures. Improvement in low-temperature flexibility by the addition of plasticizers decreased with increased hardness and became negligible at about 85 Durometer hardness.

For applications involving exposure to both low temperatures and oil, adjust the carbon black and plasticizer as follows: find the minimum amount of these materials that meet the hardness and swelling requirements and then add only sufficient carbon black and plasticizer (in such ratio as to maintain constant hardness) to meet the low-temperature flexibility requirements.

The selection of pigments is particularly important because most of the reinforcement and tensile strength is achieved with the fillers. Channel and reinforcing furnace blacks generally give optimum tensile, abrasion and tear strength. Thermal and soft reinforcing furnace blacks permit higher loadings for equivalent hardness. Non-black fillers for reinforcement are china clay, treated calcium carbonate, silicates, etc. Inert fillers to improve processing are whiting, talc, slate flour.

Krynac (Polymer Corporation-Canada) is a "cold" type, being polymerized at about 5° C. (30% acrylonitrile), and vulcanizates have mechanical properties similar to Hycar O.R.15 with superior shearing and breaking elongation. Swelling in solvents is not affected by the kinds of fillers investigated.[20]

Butadiene-acrylonitrile copolymers may be used as plasticizers for polyvinyl chloride and other vinyl polymers, not only improving the low-temperature flexibility of the latter, but providing a non-migratory plasticizer. Reed gives some useful data on this application in U.S. patent 2448004.

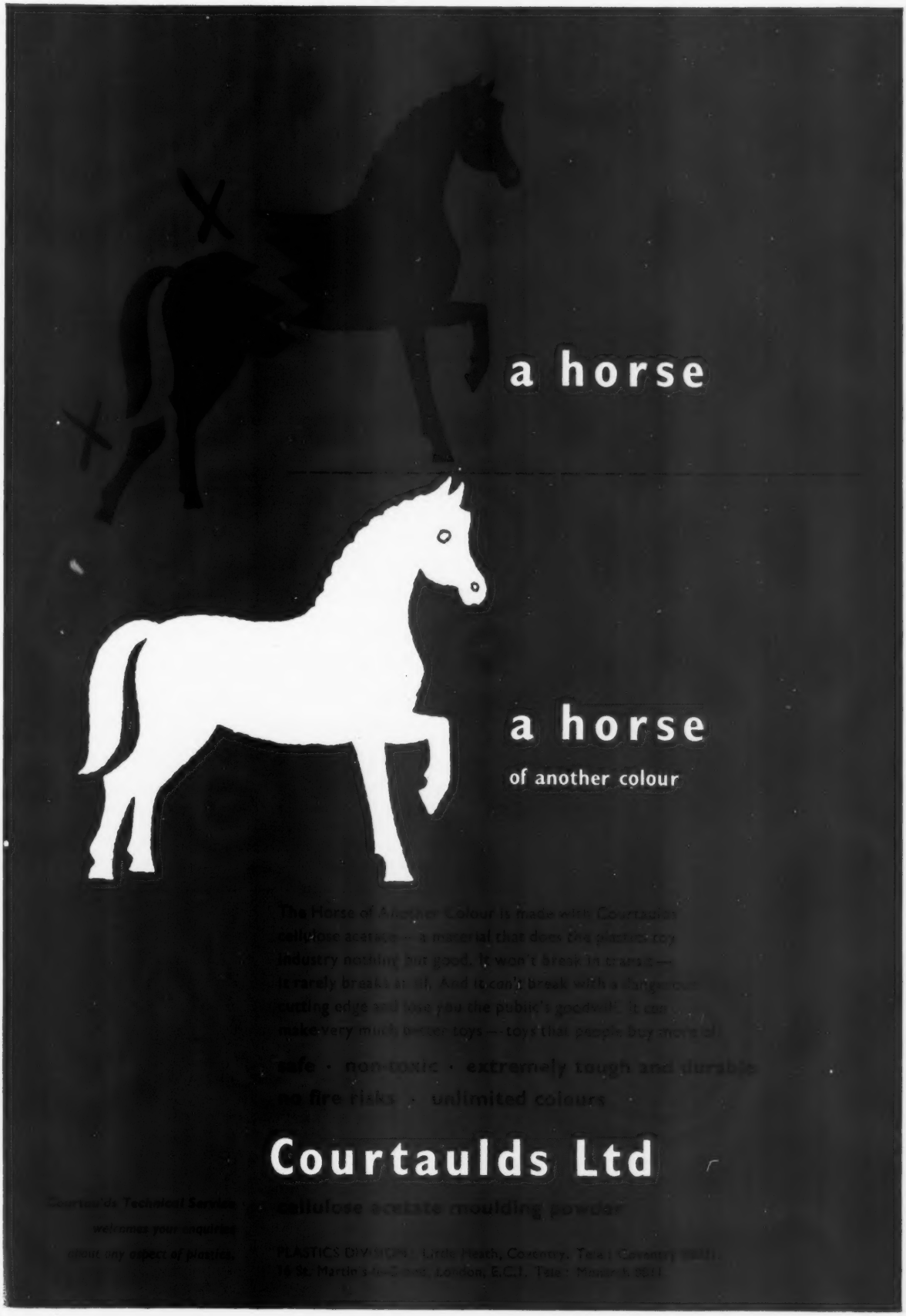
Nitrile rubber blend with phenolic resins to give products with increased hardness without excessive pigment loading, and when the phenolic is the dominant phase some interesting results are obtained:—

Table 2

	Hycar OR25	Hycar OR25–40 Phenolic –60
Tensile strength p.s.i.	2,300	4,000–6,000
Shore hardness	65	90–95

Copolymerizing with a larger amount of acrylonitrile than is usual for synthetic rubbers, and combined with a styrene-acrylonitrile copolymer, it is claimed[24] that the vulcanized product obtained gives enhanced low-temperature properties and impact strength.

An adhesive for attaching polyvinylchloride soles to footwear consists of (a) a copolymer of butadiene-acrylonitrile, (b) a solvent, (c) a vinyl chloride-acetate copolymer, and (d) a phenol-aldehyde resin.[25]


a horse
a horse
of another colour
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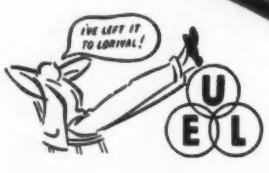
This pack for "Easicut" twist drills was produced for English Steel Corporation Ltd., Openshaw, Manchester. The assembly is made up of three separate mouldings: the drill holder, the base and cover. The holder and base are compression moulded in phenolic material. The transparent cover is injection moulded in clear Polystyrene. A phenolic cement is used to assemble the drill holder and base.

LORIVAL PLASTICS



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A nitrile copolymer containing 20% acrylonitrile is suggested for O-rings for aircraft,[22, 26] where it is noted that the higher the carbon black content, the greater the hardness, but the low-temperature flexing decreases. The grade of carbon black used has some influence on the resulting properties (see also [27, 28, 29]). Copolymers which have good low-temperature properties sacrifice some tensile strength[20].

Enkanol W., manufactured by Bayer, is a copolymer of butadiene, acrylonitrile and styrene, and is offered as a 40% acqueous emulsion as a plasticizer for polyvinyl chloride latices. Thiokol T.B.-90B is recommended as a plasticizer for some nitrile rubbers,[30] and plasticizers of the polyester type are useful where oil and petrol resistance is required, especially when good low-temperature performance is demanded as well.

Products useful as film-forming agents, varnishes, etc., are claimed by copolymerizing major portions of butadiene with equal parts of diisobutylene and chlorobenzene. Tests indicate a faster vulcanizing time and higher tensile strength[31].

Nitrile rubbers are useful for cements for bonding, not only the nitrile rubber to itself, but also to polyvinylchloride, chloroprene polymers, GR-S, etc.[32] With a priming coat of chlorinated rubber they are useful for bonding the rubber to metals, paper, ceramics, etc. Butadiene-acrylonitrile latices are also offered for coatings and, by reason of the high solid content, give a thicker coating than when solution coating is used[19].

One range of nitrile latices[33] are stable suspensions of small negatively charged particles, spherical in shape, with a small amount of fatty acid-type soap stabilizer. Various grades differ only in the amount of acrylonitrile present. They are recommended for paper coating and impregnation, leather finishing, and as plasticizers for vinyl latices. Hycar OR/25 has excellent resistance to oil[34].

2. Vinyl Chloride

(a) Vinyl chloride-vinyl acetate

These copolymers have been of industrial importance for a number of years and their main advantages are: (a) Non-toxic, no odour or taste, non-inflammable; (b) Chemically inert, being dissolved only by ketones, esters and chlorinated hydrocarbons; (c) Tough, flexible, with high water resistance; (d) Good clarity; (e) Good ageing; (f) Thermoplastic, and therefore enable films to be readily heat-sealed.

The following table gives some details regarding the Vinylite series[35].

Table 3

Grade	Vinyl-chloride	Vinyl-acetate	s.g.	Conc. solution normally used
	%	%		%
VYCC	62	38	1.30	40
VYLF	87	13	1.34	35
VYHH–1	87	13	1.36	20
VMCH	86	13*	1.35	20
VAGH	91	3	1.39	20
VYNS–3	90	10	1.36	18
VYCM	91	9	1.37	6
VYDR	95	5	1.39	14
VYNV–1	95+	5	1.39	35
VYNV–2	95+	5	1.39	50

* Plus 1% dibasic acid.

Geon 400 x 150 is also a vinyl chloride-acetate copolymer of particular interest in the surface-coating industry[36] in that it is readily soluble in a number of commercial solvents. Suitably dissolved, it gives mobile solutions of relatively high solid content, is water white and stable. The films cast from such solutions are smooth, clear and glossy.

Jones[37] deals with the general principles of formulation of polyvinyl chloride compounds, and although he does not deal specifically with copolymers, useful data in connection therewith is included, and he makes some pertinent comments on their use. He points out that p.v.c. copolymer resins require less plasticizer, and usually less in proportion to the type and amount of copolymer. When processing temperatures are limited they are of outstanding use, but their limitations should be borne in mind, e.g. they are generally more costly, more easily affected by some solvents, etc.

When formulating for surface coatings, stabilizers are usually necessary, particularly when the coatings are being heat treated (baked) and, as a class, it is stated that lead compounds are satisfactory.[35] However, other types merit consideration as lead carbonate is insoluble in the solvents used; lead, calcium and cadmium salts cause flocculation and investigation should be made of some of the newer stabilizers, such as salts of tin oxides, epoxy resins of the epichlorhydrin-diphenylpropane condensation product types, which are more soluble.[38]

Amongst the uses for these resins as surface coatings are: Leather finishes, metal finishes, container linings, laminates for fabrics, photographic prints, paper finishes, fabric finishes, tin and aluminium foil coatings, wood, etc.

Vinyl chloride-acetate resins may also be calendered and moulded in a similar manner to polyvinyl chloride provided proper adjustment is made to processing temperatures, plasticizers, and so on.

The principal uses are for packaging, luggage, floor tiles, shatter-resistant windows, battery separators, hand bags.

In connection with packaging, the ease with which the sheet can be heat-sealed is of great value. The resins may also be moulded to produce rigid or softer and more flexible products for combs, fountain pens, brush handles, etc. Extruded rods and tubes are also being manufactured for various purposes. Vinyon E fibre is a vinyl chloride-acetate copolymer which is finding use as anode bags for electroplating, filter cloths, thread, etc.

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The following abbreviations are used for journal titles in the list of references: *I.R.W., India Rubber World; Trans. I.R.I., Transactions of the Institution of the Rubber Industry; Ind. and Eng. Chem., Industrial and Engineering Chemistry; Off. Digest, Official Digest of the Federation of Paint and Varnish Clubs; Rubber Chem. and Tech., Rubber Chemistry and Technology; R.A. (N.Y.), Rubber Age, New York.*

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(To be concluded.)

PATENT REVIEW

The following abstracts have been made from specifications at the Patent Office, with the permission of the Controller of H.M. Stationery Office. The country of origin for Convention Applications is shown in parentheses. Complete specifications can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 2s. 8d. each (including postage).

B.P. 692,888. Production of patterned films. W. F. Flanagan. To: New Wrinkle Inc.

A coating of a solution of a resin or resin-like substance (vinyl chloride-acetate copolymer especially satisfactory) is selectively heated in groups so that one group only will wrinkle when water is applied to the coating.

B.P. 692,895. Hydraulic lifting ram for agricultural implements carried by a tractor. A. L. A. Morgan (France).

A toric packing ring of synthetic plastic material is preferred to the usual piston rings.

B.P. 692,900. Method of rendering textile material water repellent by means of a paraffin emulsion and a solution of a precondensate of a urea or thiourea condensation product. To: Nico Ter Kuile and Zonen N.V. (Netherlands).

B.P. 692,907. Combined film viewer and projector. H. Bresbroda (Sweden).

The casing may be moulded from plastic material.

B.P. 692,908. Self-sealing valve for inflatable pneumatic bladders or the like. W. F. Davenport, H. A. Smith (U.S.A.).

The valve of "Vinylite" film sheets is intended for pneumatic bladders inserted in the breast pockets of brassieres to correct the shape of the bust.

B.P. 692,918. Method of curving flat moulded plastic printing plates. To: News Syndicate Co. Inc. (U.S.A.). (Add to B.P. 692,865.)

B.P. 692,929. Polymeric materials and articles produced therefrom. W. E. F. Gates. To: I.C.I., Ltd.

To reduce the tendency to accumulate electrostatic charges of e.g., polyvinyl chloride, methacrylate resins, polythene, chlorinated polythene, 2 to 25% of a synthetic linear N-alkoxy-methyl polyamide is incorporated.

B.P. 692,937. Resinous compositions and thermoset resins derived therefrom. To: Westinghouse Electric International Co. (U.S.A.).

The compositions are prepared from polyhydroxybenzene-aldehyde compounds (resorcinol and paraformaldehyde).

B.P. 692,945. Adhesive tapes. To: Industrial Tape Corp. (U.S.A.).

A vinyl chloride-vinyl acetate copolymer, tricresyl phosphate, lead stearate composition is applied to a cotton cloth. The uncoated side is then passed over cold highly refined paraffin wax. The waxed strips of heat-sealing fabric could be more readily applied to garments, the iron being kept clean.

B.P. 692,957. Polymers and their preparation. To: E. I. du Pont de Nemours and Co. (U.S.A.).

Hydrocarbon polymers are obtained by the catalytic hydrogenation of carbon monoxide, under pressure, in the presence of a molybdite of a metal. Orientable films and fibres may be produced by cold drawing.

B.P. 692,967. Manufacture of light-stable vinyl resin compositions and intermediates therefor. To: Titan Co. Inc. (U.S.A.).

The composition contains from 0.5 to 10% sodium phosphite or potassium phosphite.

B.P. 692,974. Production of commutators. To: Robert Bosch G.m.b.H. (Germany).

B.P. 692,982. Method of mounting an electric condenser or other electric component in a metal case and condenser assembly according to that method. To: Standard Telephones and Cables Ltd. (Netherlands).

The terminal tags are firmly embedded in a solid resinous compound filled into the metal case in liquid state and polymerized in the case itself. The resin is of the ethoxyline type.

B.P. 693,000. Containers. Santona Ltd., T. N. Gaut.

A colloidal solution in its hot, runny condition is applied to the (paper, cardboard) container and cooled to form a gel. Then the liquid medium is evaporated at a temperature below the melting point of the gel. Polyvinyl, chloride-acetate, polyethylene, butadiene isobutylene, ethyl cellulose, polymethyl methacrylate may be used.

B.P. 693,035. Presses. Jackson, Heywood and Co. Ltd., L. Kay.

A twin-type press is characterized in that one moving element of each pair is interconnected with the corresponding moving element of the other pair through a rope or a chain passing around pulleys or sprockets. When plastic moulding small articles (buttons), one mould may be pressed for curing while the other is being emptied and refilled.

B.P. 693,051. Resinous compositions and laminated products utilizing the same. R. Lindenfelser, M. K. Kilthau. To: American Cyanamid Co. (U.S.A.).

The compositions are obtained from an uncured aldehyde aminotriazine resin and a polyvinyl plasticizer. Both ingredients are prepared in a certain way and the resulting compositions are useful for any application where hard, craze-resistant, light-coloured and light-stable coatings are required. They are also suitable for moulding small transparent or pearl-like objects (e.g., buttons).

B.P. 693,062. Electric capacitors. D. S. Girling. To: Standard Telephones and Cables Ltd.

A dried capacitor unit is impregnated in vacuo with a thermosetting resin (aryl substituted ethylene oxide) and a hardener (phthalic anhydride) and sealed within a metal casing using the same resin mixture. The resin is cured by a final heat treatment.

B.P. 693,103. Liquid methyl polysiloxane compositions. Soc. des Usines Chimiques Rhône-Poulenc (France).

B.P. 693,111. Topochemical modification of cellulose textile materials. C. A. Fetscher. To: Cluett, Peabody and Co. Inc.

A process by which the cellulose of fibre, yarn, fabric may without destruction of the physical form of the cellulose body, be converted into a cellulose-resin composite in which cellulose and resinous material are chemically combined.

B.P. 693,112. Electrophotographic plate and method of producing same. To: Battelle Development Corp. (U.S.A.).

Photoconducting insulating material is uniformly dispersed in a thermoplastic synthetic resin (polystyrene, chlorinated rubber, silicone resin, acrylic resin, vinyl-chloride-acetate resin).

B.P. 693,135. Closures for bottles, jars and similar containers. A. C. Lindstrom (Sweden).

A conical (polyethylene) sealing element is used.

B.P. 693,139 and 693,140. Birdcages. Hygienic Wire Works Ltd., J. T. Dowdall, P. E. Haycraft.

Base and tray may be moulded from synthetic resin.

B.P. 693,153. Machines for working (incl. mixing, plasticizing and preheating) rubber and like plastics and compositions having a base thereof. To: Pirelli S.p.A. (Italy).

B.P. 693,161. Electro-mechanical transducer unit. Brush Development Co., T. E. Lynch.

The crystal unit is embedded in Vinylite or in Korogel (plasticized polyvinyl resin).

B.P. 693,172. Production of polymer intermediates from hydrazine and dicarboxylic acids and production of polymers therefrom. J. W. Fisher, E. W. Wheatley. To: British Celanese Ltd.

B.P. 693,188. Aqueous dispersions of pigmented alkyd resins. W. A. Waldie. To: Commonwealth Engineering Co. of Ohio.

Coating composition in form of emulsion.

B.P. 693,240. Ornaments for use, for example, in decorating Christmas trees. G. S. Marston.

Lampholder and central member may be made from a moulded plastic.

B.P. 693,272. Sales packing for artificial fishing bait. A. Hoergard.

B.P. 693,282. Sealing means for plastic bags and methods of preparing same. A. C. Anselmi.

A strip of aluminium foil backed with paper or fine muslin is secured by adhesive outside one of two registering edges of the mouth of the plastic bag extruded in tubular form (polyethylene, methyl methacrylate polymer, polyvinyl chloride). The bag is closed by folding the strip over the edges.

B.P. 693,347. Electromagnetic head. M. Camras. To: International Research and Development Corp.

The head in magnetic recording apparatus includes a non-magnetic housing which may be made of aluminium or of Bakelite.

B.P. 693,371. Joints and joint covers for multiple conductor electric cables. K. A. Fillmore, A. W. J. Cordrey. To: Telegraph Construction and Maintenance Co. Ltd.

The cover is formed in three portions from polythene or a polythene compound.

B.P. 693,375. Fibre-forming linear polymers. To: California Research Corp. (U.S.A.).

The novel highly polymeric derivatives of stilbene dicarboxylic acid possess fluorescence, higher receptivity for dyes, higher

melting points and may also be used as coatings or moulding compositions and in conjunction with polyesters and polyamides and known additives.

B.P. 693,389. Filling long flexible tubes of tube-sealing machines. W. T. Johnson.

The p.v.c. tube is slid as a sheath over a long hollow nozzle and is progressively withdrawn while being filled.

B.P. 693,450. Press for consolidating finely divided materials. F. H. Clark, C. A. Lees (add. to B.P. 669,835).

The press, e.g. for moulding plastic materials from moulding powder, has a bottom die slidable in the mould backed by a bottom ram for ejecting the compressed moulding. The movement is controlled by a sleeve in co-operation with catches and a spring.

B.P. 693,484. Process for impregnating wood. To: Office National d'Etudes et de Recherches Aeronautiques (France).

The wood is soaked with solvent for the impregnant (thermosetting or thermoplastic resins), then brought into contact with the dry impregnant. Resins mentioned are CIBA 186 (containing melamine formaldehyde) and Polystyrol F of the Soc. Rhône Poulenc.

B.P. 693,496. Production of aqueous dispersions of vinylidene chloride copolymers and of moistureproof sheet wrapping material produced therefrom. W. Berry, C. R. Oswin, J. Boyd. To: British Cellophane Ltd.

B.P. 693,547. Method for the production of flexible tubes. A. Auer (Austria).

The tube, made by winding a strip of material and grooving it, is continuously covered by rubber or a synthetic plastic substance extruded through an annular orifice concentric with the tube.

B.P. 693,549. Bushings for abrasive wheels. To: Carborundum Co. (U.S.A.).

The bushings are made by an injection moulding method from an organic thermoplastic or thermosetting resin. The composition, e.g., "Tenite I or II" or "Lumarith" (cellulose acetate; cellulose acetate butyrate), but also many other resins, is forced into the arbor hole of the wheel and set conforming closely to the granular configurations of the original hole.

B.P. 693,556. Track for model railways. J. G. Hefford, G. E. Mellor.

B.P. 693,629. Reeds for textile purposes. M. M. Taylor. To: British Celanese Ltd.

The reed wires are held, e.g., in ribs of reinforced cellulose acetate plastic material, and bound by cellulose acetate filaments doubled with other yarn. The ribs are softened to coalesce with the filaments.

B.P. 693,647. Process of and apparatus for pressing sheets of thermoplastic materials. R. Hagen (Germany).

For re-pressing (polyvinyl chloride) sheets to make them uniformly hard and smooth, the sheets are first heated between thin metal sheets, then removed while still between the sheets to be introduced between cooled pressure platens and there left to cool under pressure.

B.P. 693,651. Spreadable compositions adapted to be hardened to resinous masses and hardening process for the same. To: N.V. de Bataafsche Petroleum Maatschappij (U.S.A.).

A particular class of cyano-substituted hydrocarbons can be used to render spreadable the glycidyl ethers of a polyhydric organic compound. Such compounds are suitable as adhesive and also as a casting resin.

B.P. 693,664. Shoe welt. C. F. Batchelder, Jr.; L. Withinton, Jr. To: Wright-Batchelder Corp.

The welt is made of plasticized, polymerized resin (equivalent to polyvinyl chloride).

B.P. 693,692. Polymerization of vinyl chloride. V. L. Folt. To: B. F. Goodrich Co. (U.S.A.).

Rapid polymerization in an aqueous medium containing only the monomeric vinyl chloride, water and, as a catalyst-activator, a peroxygen compound and an ionizable silver compound.

B.P. 693,699. Production of cellulose esters. J. G. Davoud. To: Courtaulds Ltd.

Bleaching with sodium chlorite under acid conditions effectively bleaches discoloured compounds present in the ester. On moulding, heat-stable crystal-clear articles are obtained.

B.P. 693,711. Flexible web or sheet composed of fibrous materials agglutinated by adhesives. K. J. Harwood. To: International Cellucotton Products Co. (U.S.A.).

Non-woven fabric is formed of an air-laid web of cotton fibres cross-printed with lines of an adhesive of thermoplastic resin polymers or copolymers of linear chain formation (Vinylite AYAF or VYNW-2, Nylon, Vinyon, Saran, etc.).

B.P.693,717. Film casting surfaces. To: Celanese Corp. of America (U.S.A.).

B.P. 693,747. Resinous compositions. To: British Thomson-Houston Co. Ltd. (U.S.A.).

A room temperature setting adhesive composition is derived from the resinous condensation product of bis-phenol and an epihalogenohydrin.

B.P. 693,760. Method for the preparation of fusible lignin resins. To: Institut International Financier (Switzerland).

B.P. 693,788. Polysiloxane composition and method for treating cellulose fibrous sheet material therewith. To: Dow Corning Ltd. (U.S.A.).

B.P. 693,795. Detonator shields. A. J. Lowe. To: I.C.I. Ltd.

B.P. 693,864. Ternary acrylonitrile polymers. To: American Viscose Corp. (U.S.A.).

B.P. 693,914. Commutators for electrical machines. To: S.A. des Machines Electrostatiques (France).

The supporting member of insulating material is formed of a mouldable synthetic resin.

B.P. 693,915. Method for the production of adhesive coatings on backing materials. To: Scholl Mfg. Co. Inc. (Switzerland).

A very homogeneous adhesive solution for tapes for technical and medicinal purposes which does not dry up can be prepared from one and the same polyvinyl alkyl ether in different degrees of polymerization.

B.P. 693,916. Method and apparatus for the production of adhesive tapes with a porous coating, in particular for medicinal purposes. To: Scholl Mfg. Co. Inc. (Switzerland).

Air and moisture permeable adhesive plaster strips which irritate the skin as little as possible are prepared by applying the heated adhesive, e.g., according to B.P. 693,915, to one face of the tape while simultaneously applying cooling water to the opposite face. This limits permeation and accelerates setting of the adhesive so that pores form therein.

B.P. 694,095. Motor road vehicles. D. E. Hobbs. To: Bristol Aeroplane Co. Ltd.

Plastic sheeting may be employed or sandwich material impregnated with a synthetic resin and cured. Coloured resins may make subsequent painting of the body unnecessary. Parts may be joined under heat (high-frequency currents) and pressure, bolts and brackets attached during moulding.

B.P. 694,168. Transfers. H. E. Peace.

The composition includes a thermosetting melamine resin, e.g., of the Beetle Products Co. Ltd. (L.391).

B.P. 694,174. Viscosity-stable casein adhesive. To: National Starch Products Inc. (U.S.A.).

B.P. 694,217. Production of flame-proof cellulose derivatives. To: Celanese Corp. of America (U.S.A.).

Organic derivatives of cellulose containing free hydroxyl groups may be flame-proofed and even rendered permanently non-flammable by reacting them with a halo-alkyl ester of a halo-phosphoric acid. The flame-proofed materials are resistant to washing solvents, the modified derivatives may be compression or injection moulded or extruded.

B.P. 694,224. Elements for photo-lithography. G. F. Nadeau, C. B. Starck. To: Kodak Ltd. (U.S.A.).

A metal foil and a layer of cellulose organic acid ester are bonded by a copolymer of vinyl chloride, vinyl acetate and an unsaturated dicarboxylic acid.

B.P. 694,253. Manufacture of polymers containing plasticizers. M. Erlenbach, A. Sieglitz (Germany).

The polymerization is carried out in an aqueous medium while simultaneously introducing the monomer (vinyl chloride) or a mixture of monomers and the plasticizer at the rate at which they are consumed.

B.P. 694,264. Powder feed and measuring mechanism for plastic moulding presses. A. Worswick. To: Foster, Yates and Thom Ltd.

A roller with a series of compartments is oscillated within a casing having powder feed and delivery branches.

B.P. 694,270. Spoon. G. A. Elliott. To: B.E.F. Tools Ltd.

A jam and pickle spoon is injection moulded (from polystyrene, cellulose acetate or the like) with a hook to hold the spoon on the rim of the jar.

B.P. 694,271. High-density mouldable polymers of ethylene. To: E. I. Du Pont de Nemours and Co. (U.S.A.).

The process is based on the fact that (contrary to published information) ethylene polymers increase in stiffness not with increasing molecular weight but with increasing chain linearity.

B.P. 694,330. Process for preparing nitrogen-containing thermosetting resins and wet-paper produced therewith. G. E. Niles. To: Monsanto Chemical Co. (U.S.A.).

A methylolated urea is formed, then glycine and formaldehyde (or similar products) are added.

B.P. 694,367. Mechanism for printing on tape. A. McLellan.

The tape may be of Cellophane.

B.P. 694,377. Sealing apparatus. A. C. Buckhurst, R. C. James. To: British Cellophane Ltd.

B.P. 694,379. Tubular articles, for example lamp shades. G. W. Borkland (U.S.A.).

A flat strip of thermoplastic material is bent when cold into a cone, then placed on a die with cavities and heated and formed under fluid pressure which forces (previously printed) portions of the cone into the cavities to obtain (coloured) embossed designs.

B.P. 694,408. Preparation of vinyl halide copolymers. To: N.V. de Bataafsche Petroleum Maatschappij (U.S.A.).

When vinyl halide polymer chains are heated in the presence of a peroxide catalyst, active nuclei are produced to which the molecules of the dissimilar monomer subsequently become attached. The process is applied to the production of "internally" plasticized polymers. The copolymers may be machined, may be used for coatings, extruded, injection or compression moulded. They are particularly useful for food wrappings because of the absence of deleterious plasticizers.

B.P. 694,427. Reservoirs for writing instruments. H. Hutchinson. To: Biro Swan Ltd.

B.P. 694,433. Polymers. J. Downing. To: British Celanese Ltd.

Vulcanizable polymers are obtained by partial dehydrochlorination of addition polymers of unsaturated mono-olefinic compounds.

B.P. 694,444. Dispersions of vinyl chloride resins in plasticizers containing polyglycol methacrylates. To: Union Carbide and Carbon Corp. (U.S.A.).

B.P. 694,463. Heat-sealable splicing tape resin and process for preparing same. L. M. Geramin. To: Shawinigan Chemicals Ltd. (U.S.A.).

The process relates to the preparation of polyvinyl alcohol-acetate resins containing 45% to 65% polyvinyl acetate. Scrap paper spliced with a film of it, when returned to the beater, does not cause defects as the film is water dispersible.

B.P. 694,474. Method of stabilizing polymers comprising vinyl or vinylidene chlorides. J. E. Costa, O. R. McIntire. To: Dow Chemical Co.

B.P. 694,512. Eyes for dolls, soft toys, furs for wear and the like. K. B. Williams (add. to B.P. 634,614).

B.P. 694,527. Press. F. Blaskopf (Austria).

For stamping small articles from metal or artificial resin, the high-speed multiple press is characterized by a lifting spring (for each cam-operated press plunger) which bears against a member adjustable in two positions for varying the stressing of the spring.

B.P. 694,538. Electric batteries. To: Soc. des Piles Wonder (France).

Each cell is mounted in a frame of polystyrene or polyethylene.

B.P. 694,593. Spectacle frames. N. W. Chappell.

B.P. 694,649. Feeding of moulding powder and the like. To: A.C.I. Plastics Proprietary Ltd. (Australia).

Above a table with a mould cavity is arranged a feed member with a measuring compartment of adjustable size. The compartment is moved from the supply point sliding over the table to the mould to deposit the measured charge.

B.P. 694,669. Containers. F. H. Packer. To: General Stampers Ltd.

The container is constructed of, e.g., polyvinyl chloride for use in connection with a metal drum.

B.P. 694,676. Construction of electrical condensers. R. A. Stephen.

A composite strip of thermoplastic material (polystyrene) and metallic layers is wound on a cylindrical mandrel and heated to cause the thermoplastic material to flow around the edges of the metallic layers. The mandrel may also be of plastic material and then remain in the condenser.

B.P. 694,695. Soft container with a window. C. Marsan.

A transparent part (window) is fastened along a line angularly disposed to any edge of the fabric part.

B.P. 694,716. Silicon-containing alkyd resins. To: Libbey-Owens-Ford Glass Co. (U.S.A.).

B.P. 694,720. Machine for bagging confectionery and like commodities. R. W. Barraclough Ltd. (formerly Philips Southport Works Ltd.), R. W. Barraclough.

The machine has been developed particularly for using plastic film bags.

B.P. 694,724. Electric terminal block. F. L. Ebel, P. H. Coutts. To: Fairey Aviation Co. Ltd.

The block body is moulded from synthetic resin.

B.P. 694,740. Display case or structure. H. S. Newcomb. To: Warerite Ltd.

The unit may be made up of fibrous sheets bonded with heat-hardened synthetic resin or of plywood veneered with such sheets.

B.P. 694,743. Closure caps for sealing jars and similar containers. W. Engel.

A polyvinyl chloride washer is formed in situ in the cap from a paste set by superficial coagulation in the cap before final heat treatment.

B.P. 694,761. Process for the production of polymerization products. To: Nederlandse Organisatie voor Toegepast-Natuurwetenschappelijk Onderzoek ten Behoeve van Nijverheid, Handel en Verkeer (Netherlands).

A complex polymerization from chloroparaffins and styrene.

B.P. 694,806. Method for preparing synthetic resins from dicyandiamide. To: Sueddeutsche Kalkstickstoff-Werke AG.

B.P. 694,812. Handles. A. D. Baker. To: Joseph Lucas (Industries) Ltd.

For gear change levers with an indicator insert.

B.P. 694,857. Articles made from flexible thermoplastic rod. B. E. M. Miller. To: British Celanese Ltd.

For tablemats, lampshades, baskets. The extruded (cellulose acetate) rod is wound in continuous turns caused to adhere to one another to provide a ribbed surface of pleasing appearance.

B.P. 694,870. Process for increased clarity and transparency of polyethylene products. To: Plax Corp. (U.S.A.).

The continuously extruded film is heated for a minimum clearing time out of contact with solid objects, then promptly quenched.

B.P. 694,911. Polymerization of N-substituted unsaturated amides. To: Celanese Corp. of America (U.S.A.).

B.P. 694,969. Metal-sheathed electric cables. Johnson and Phillips Ltd., P. H. Raine.

A protective covering is used of plasticized polyvinyl chloride less than 0.02 in. thick which serves as a barrier against electrolytes and stray currents.

B.P. 695,012. Extrusion apparatus. R. V. Rowles. To: Fielding and Platt Ltd.

Sheathing of electric cables using metals, synthetic resins or plastics.

B.P. 695,017. Hat boxes. J. I. Krantz.

B.P. 695,033. Method of making crinkled artificial fibres. N. W. Abernetly. To: Dow Chemical Co.

A crystalline polymer or copolymer of vinylidene chloride is extruded downwardly into streams of gas inert to and cooler than the filaments converging upwardly to form a cone.

B.P. 695,037. Process for making resinous compositions for the manufacture of articles having a self-lubricated surface. To: British Thomson Houston Ltd. (U.S.A.).

A phenol formaldehyde resin is mixed with a filler, then blended with a powdered lubricant.

B.P. 695,067. Composition of matter. R. de Mott Fine III. To: Atlas Powder Co. (U.S.A.).

For sizing synthetic textiles (polyamides, vinyl and vinylidene polymers), a polymethacrylic acid is partially neutralized and combined with a plasticizer and a polyoxyethylene derivative as a lubricant.

B.P. 695,105. Process for the manufacture of vinyl chloride. M. Erlenbach, A. Sieglitz (Germany).

Manufacture by additive combination of hydrogen chloride with acetylene.

B.P. 695,117. Preparation of resinous materials. To: Phillips Petroleum Co. (U.S.A.).

Reaction between sulphur dioxide and one or more unsaturated organic compounds.

B.P. 695,133. Flanged bobbin with snap-on protected edge. J. J. Bliss. To: Acrometal Products Inc.

The bobbin heads are of moulded nylon.

B.P. 695,160. Luminescent polymerizates. To: Farbenfabriken Bayer (Germany).

Vinyl compounds are subjected to pearl polymerization with the addition of luminescent pigments and a thickening agent.

B.P. 695,210. Process for making moulded articles which become acid-resistant on being contacted by an acid. Richardson Co. (U.S.A.).

A storage battery case is moulded from a catalytically polymerized furfuryl alcohol (or a phenol formaldehyde or phenol-furfural condensation product) neutralized and dispersed in a moulding composition containing an acid-attackable filler and a binder. The case is moulded without further polymerization.

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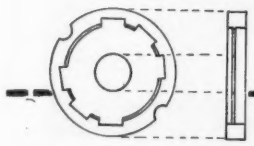

The diagram above gives details of the discs which were clamped rigidly between steel plates to form the rotary switch. Note the wafer thinness at the centre.

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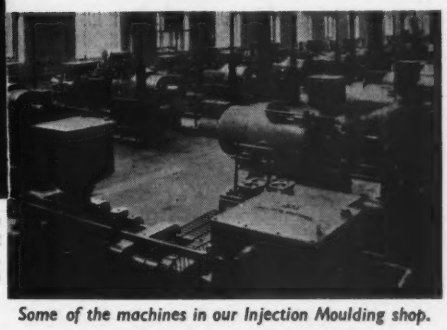

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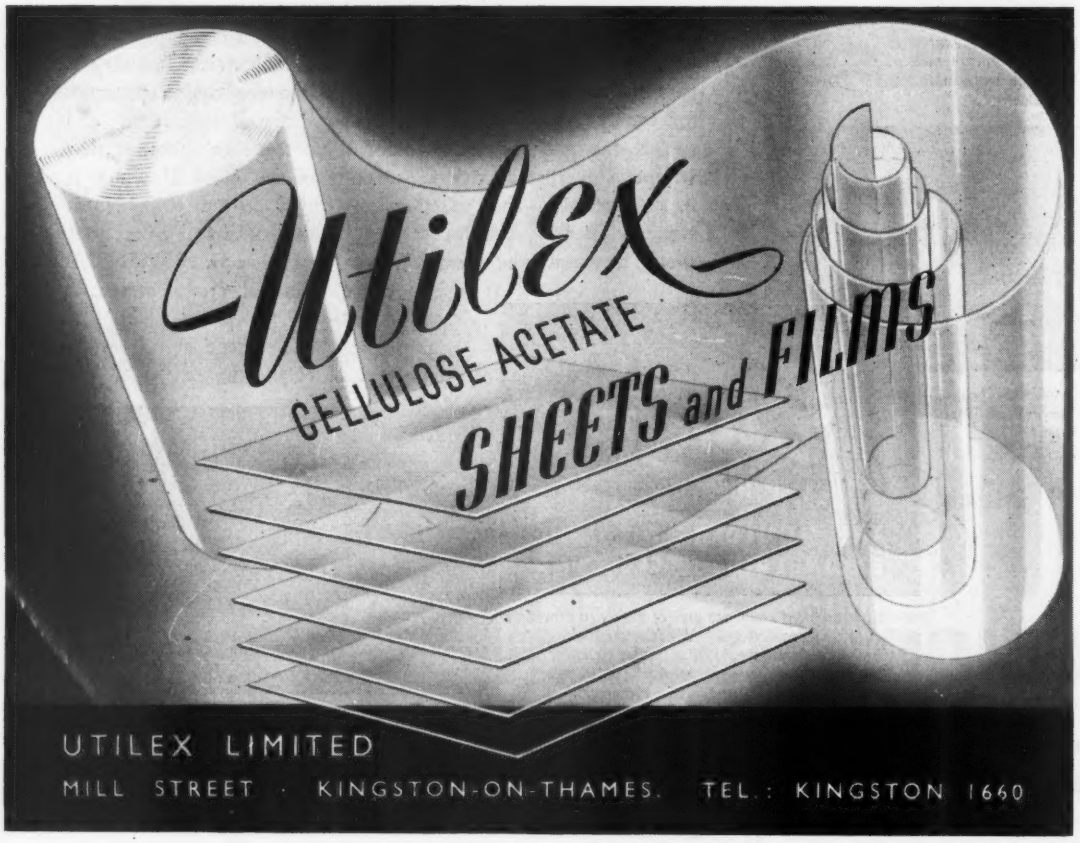
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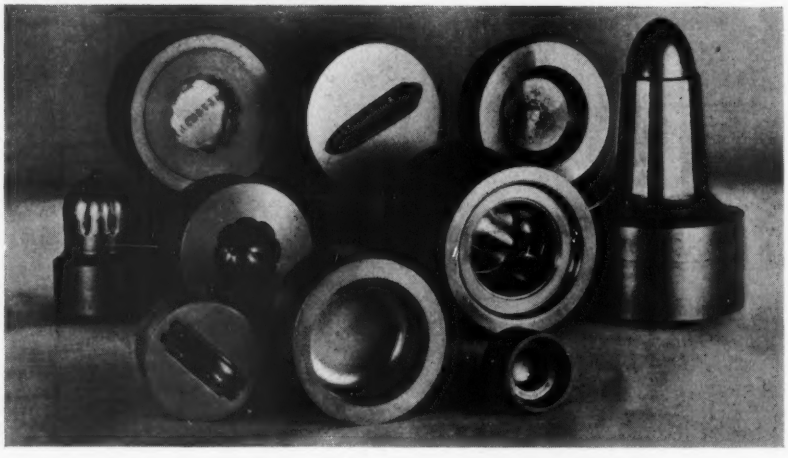

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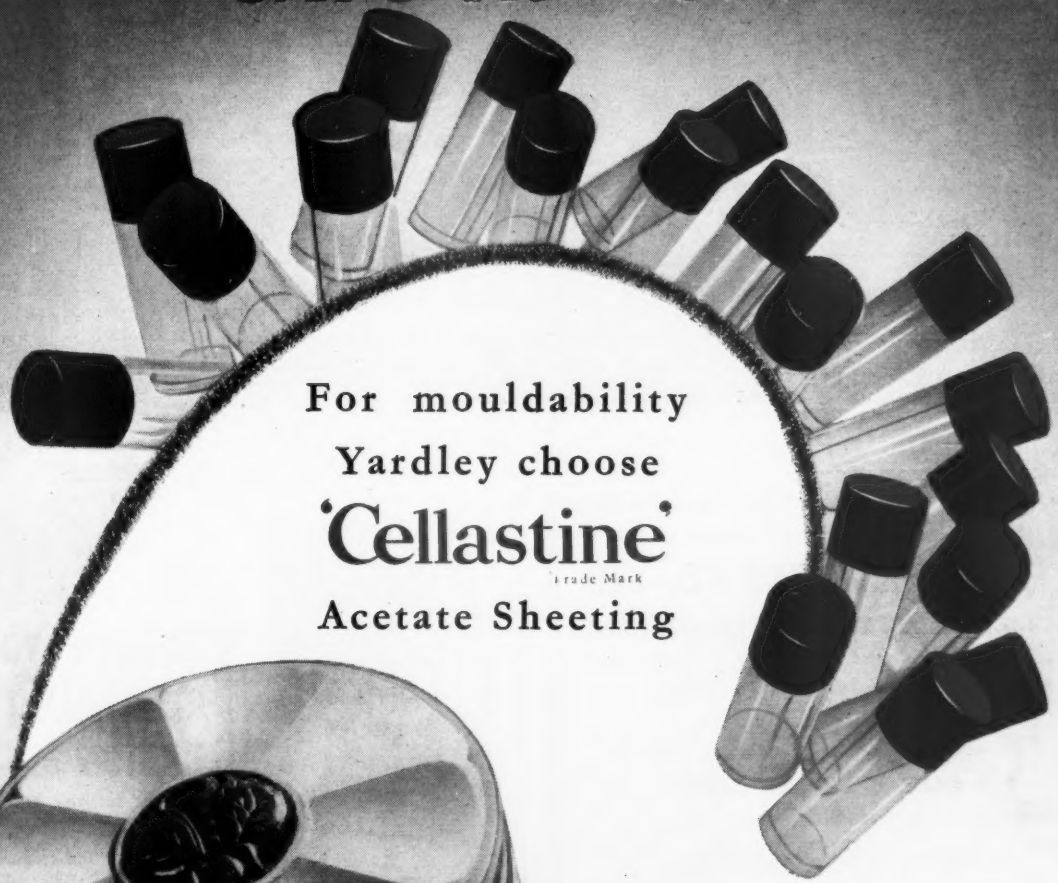

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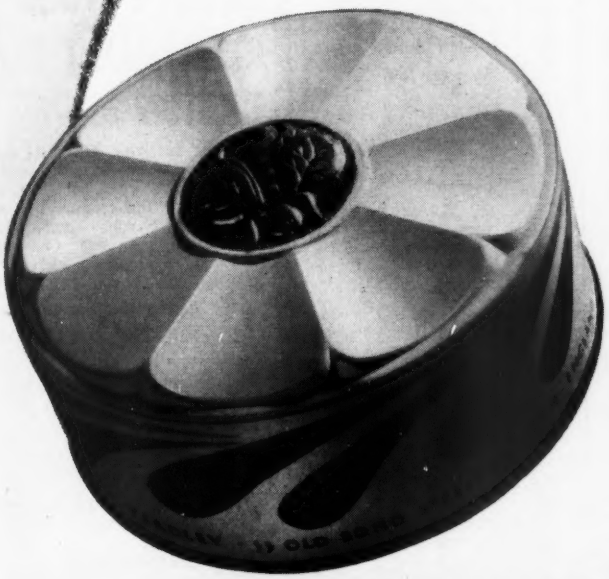

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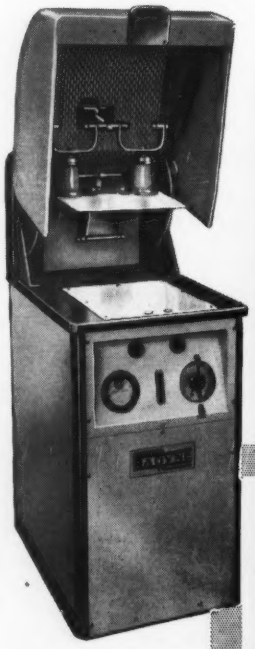

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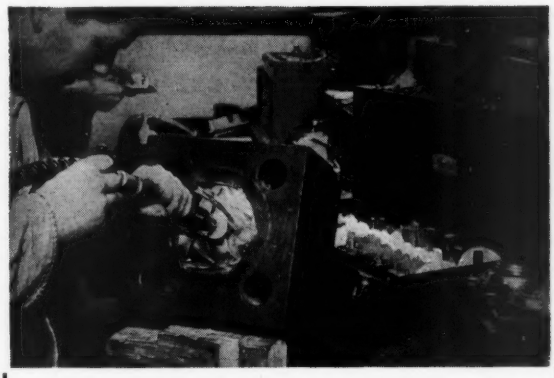

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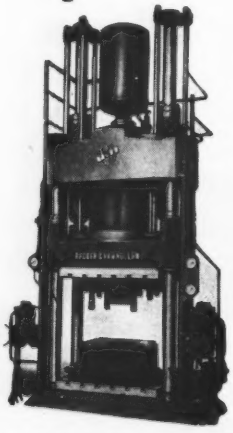

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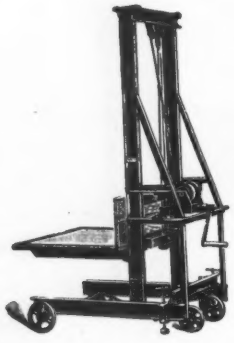

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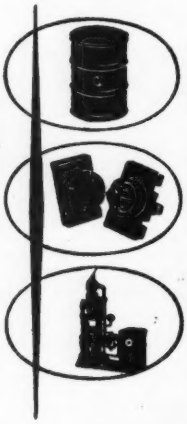

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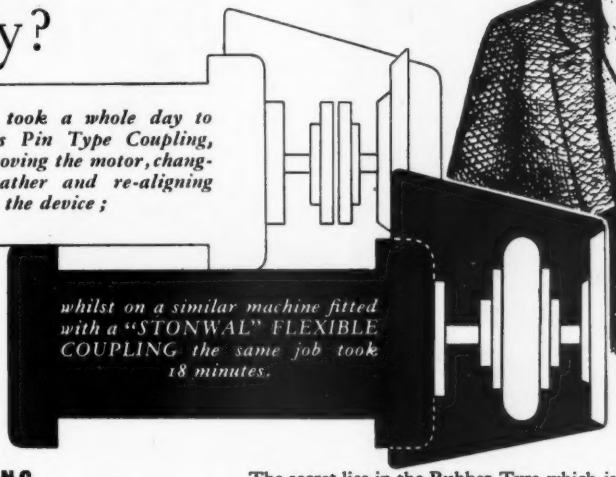

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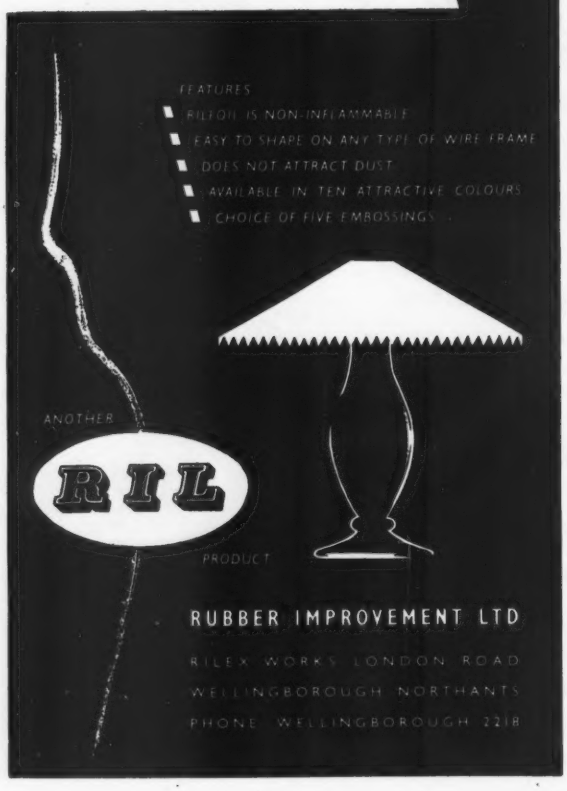

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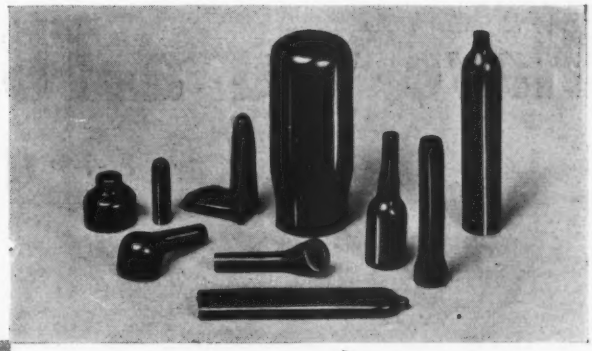

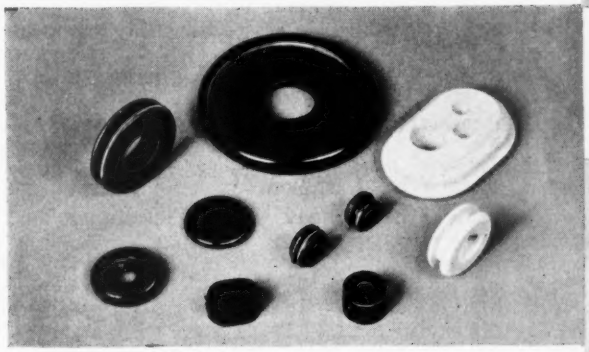

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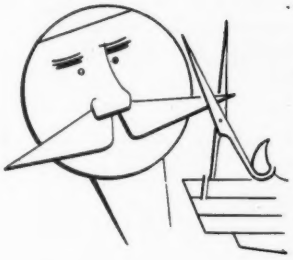

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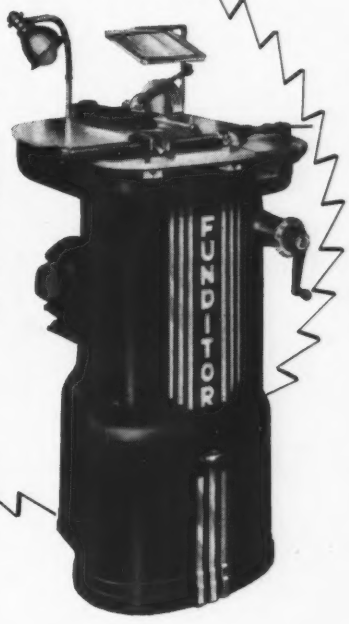

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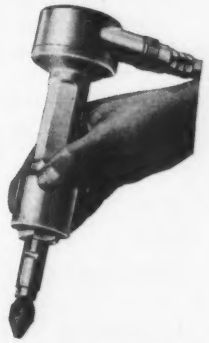

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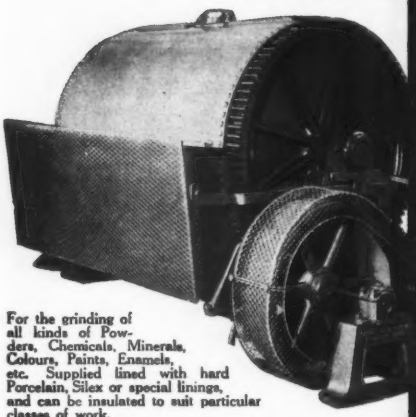

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The Vavanite P.M.P. Extender blends naturally with most standard phenolic moulding powders . . . often improves the flow time of the powder . . . saves substantial percentage of powder costs . . . imparts a higher lustre and harder surface to the mouldings.

Vavanite is also extensively used as a filler for synthetic glues in plywood and allied industries.

Vavanite

Write for free samples and literature now to address below

J. H. VAVASSEUR & CO. LTD.

Ceylon House, 15-16 America Square, London, E.C.3, England. Tel. Royal 3130. Telegrams Citronella, London

MASTRAL

PLATING AND POLISHING EQUIPMENT

E323 POWDER BLENDER

★ **Ensures uniform distribution of all particles when mixing various ingredients of moulding powder compositions.**

★ **Uniform blending.**

★ **No variation in characteristics of product.**

★ **No internal moving parts.**

★ **Easy to fill, empty and clean.**

★ **Stainless steel lining.**

★ **Capacity: 7 cu. ft.**

Write for leaflet No. P/E.323

THE KINGSLAND ENGINEERING CO. LTD.

25/37 HACKNEY RD. LONDON, E.2.

Tel: SHOreditch 5635 Grams: KINGENGCO. LONDON

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BUSINESSES, PREMISES, OFFICES, ETC.—WANTED

SMALL TRADE MOULDING SHOP, region London area. Box P9320, care of "Plastics." 197-1027

MACHINERY, TOOLS AND PLANT

ALTERNATORS. Diesel sets, electric motors, switch gear, transmission equipment, fluorescent lighting and industrial fittings ex stock, keen prices. Contact G. L. Murphy, Ltd., Menston, near Leeds. zzz-210

HYDRAULIC. Frazer Mono-radial pumps, new and second-hand, in stock. Thompson and Son (Millwall), Ltd., Cuba St., London, E.14. East 1844. zzz-440

PLASTICS MACHINERY

Hydraulic Presses of all sizes. Injection Machines, Extruders, Mixing Mills, Hydraulic Pumps and Accumulators.

Send your inquiries to the specialists,

REED BROTHERS (ENGINEERING), LTD.,

REPLANT WORKS,

CUBA STREET, MILLWALL, E.14.

Phone, East 4081 (five lines). zzz-335

FOR SALE. P.E.C. size "O" automatic pump with high- and low-pressure plungers. Delivery 3.8 gallons both plungers together, high only 1 gal./minute up to 1 ton/sq. in. Complete with 4 h.p. single-phase 205-volt A.C. Brooks motor with starter. Contact Secretary, R.A.B.R.M., 105-7 Lansdowne Rd., Croydon. 196-1025

SIXTEEN 200-TON EX.-M.o.S. UPSTROKE HYDRAULIC PRESSES. 10¾-in. ram, 15-in. stroke, 6¼-in. columns, table 25 in. by 15 in., all-steel head.

Sixteen 200-ton ex-M.o.S. downstroke hydraulic presses, 10⅛-in. ram, 15-in. stroke, 6¼-in. columns, table 25 in. by 15 in., all-steel head.

Eight 200-ton H.E.C. double-ram upstroke and downstroke hydraulic presses, 10¾-in. and 10¼-in. rams, each 15-in. stroke, 6¼-in. columns, table 25 in. by 15 in.

One 150-200-ton Lehman upstroke hydraulic press, 14-in. ram, 5-in. columns, 48-in. daylight, 24 in. by 17 in. table, 150 tons at 2,240 p.s.i., 200 tons at 5,000 p.s.i.

Forty-five Frazer Mono radial hydraulic pumps, motor driven, 3 h.p., 3-50-400, 0 to 6½ g.p.m. variable, 750 p.s.i., with bedplate and oil tank, as new.

Also other pumps, accumulators, etc., small presses one to 20 tons, control gear, etc. Hodson and Co. (Machinery), Ltd., Spring Mills, Tottington, near Bury, Lancs. Phone, Tottington 123-4. 196-8

MISCELLANEOUS PLANT.

Ideal clicking machine, model No. 5 by B.U.S.M. Table 35¾ in. by 18 in., motorized.

42-in. by 16-in. 2-roll mixing mill by Francis Shaw, motorized 60 h.p. through reduction gear, friction ratio 1.2 : 1.

40-in. by 16-in. double-geared mixing mill by Francis Shaw, arranged for friction and even speeds, motorized 50 h.p. through reduction gear.

Two 10 gr. hand injection moulding machines by Francis Shaw, tie bars 1½-in. dia., distance between 7½ in., machines fitted with band type electric heating equipment and Sunvic control, also Cambridge Thermostat; latest type machine mounted on steel frames.

George Cohen, Sons and Co., Ltd., Wood Lane, London, W.12. Phone, Shepherd's Bush 2070 and Stanningley, nr. Leeds. Phone, Pudsey 2241. 196-11

PELLETTING MACHINES.

Daniels No. 3, pellets up to 2¾ in. dia., output 26 per min.; included punches and die for this size; fully guarded with hopper feed and chute discharge, driven by 10 h.p. motor.

"Courtoy" single punch for tablets up to 2¼-in. dia., punch stroke 3 in., ejector stroke 1½ in., filling depth adjustable up to 1½ in., output approx. 35 per min.; with or without 5 h.p. motor.

Single-punch No. 2A by Daniels, suitable for tablets up to 1½-in. dia., but fitted with punch and die for 1⅜-in., output approx. 30 per min.; included is feed hopper, 5 h.p. motor, etc.

Three single-punch by Bradley and Turton, model P.2, pellets up to 1¾-in dia. by ½-in. thick at rate of 35 per min., pressure exerted 30 tons, driven by 4 h.p. motor, adjustable filling depth, mechanically-operated hopper and discharge shoe.

Single-punch machine, adjustable stroke and adjustable filling depth up to max. ⅝ in., fitted with feed hopper; F. and L. pulley drive suitable for producing tablets up to ½-in. dia.

George Cohen, Sons and Co., Ltd., Wood Lane, London, W.12. Phone, Shepherd's Bush 2070 and Stanningley, nr. Leeds. Phone, Pudsey 2241. 196-10

Machinery, Tools and Plant (contd.)

TWO HYDRAULIC MOULDING PRESSES, each complete with dial gauge glass, connections, on/off valve, eight daylights platens 9-in. by 6-in opening 1½-in., steam heated, water cooling, for appointment to view write Hadley Co., Ltd., Portsmouth Rd., Surbiton, Surrey, or phone, Emberbrook 2710. 196-x427

FOR SALE. Hydraulic two column plastics press with a working platen area of 8-in. by 8-in. and a maximum daylight of 12-in. and a hydraulic lift of 6-in. Fitted with electrical hot plates and manufactured by Apex Construction Co. Ideal for laboratory or pilot plant works. Box P962, care of "Plastics." 198-1033

WINDSOR S.H.3 INJECTION MOULDING MACHINE, excellent working order, can be seen in operation by appointment. Apply Box P951, care of "Plastics." 196-41

FOR SALE, two 50-ton Turner presses, one recent make, other of early prototype design, cheap. Box P9610, care of "Plastics." 196-33

T.M.A. S.H.3 THREE-OUNCE INJECTION MACHINES for sale, choice of two, 400/440 3 phase 50 cycles, 380/420 3 phase 50 cycles, serial number 3114/2 and 3233. Can be seen working, perfect condition, £750 each or offer. Reply Box P9612, care of "Plastics." 196-31

FOR SALE. One R.C. 65 extruder by Windsor, has been very little used.

One 20-in. by 10-in. Masson Rotary Cutter by Blackfriars.

Also available one 39-in. sheeting die. Replies and offers to Box P9620, care of "Plastics." 196-25

HYDRAULIC PRESSES.

400-tons Upstroke Press by Greenwood and Batley. 16 in. dia. ram by 28 in. stroke, four columns 20½ in. by 17¾ in. between, table area 36 in. by 18 in. Daylight 41 in. W.P. 2 tons.

250-tons Upstroke Press by Henry Berry. 15 in. dia. Fescolised ram by 20 in. stroke. Four columns 2 ft. by 1 ft. between. Table area 2 ft. by 22 in. Daylight 20 in. W.P. 1½ tons.

200-tons Downstroke Press by Hydraulic Eng. Co. D/a piston type ram 14½ in. dia. by 13 in. dia. rod by 20 in. stroke, arranged for prefilling. Table area 30 in. by 21 in. Daylight 30 in. Below fixed table; ejector ram D/a piston type 3⅞ in. by 3⅝ in. dia. rod by 4½ in. stroke, constant pressure return. Self-contained Pump, motor, control valve, supply tank, etc.

150-tons Downstroke Press by Francis Shaw. 14 in. dia. ram by 2¾ in. side pullbacks by 26 in. stroke Four columns 28 in. by 12 in. between. Table area 28 in. by 26½ in. Daylight 28 in. Below fixed table 4½ in. dia. ram by 12 in. stroke, working through hole in table. Arranged for automatic prefilling. W.P. 1 ton.

120-tons Downstroke Press by Hydraulic Eng. Co. D/a piston type ram 8¾ in. by 7⅝ in. dia. rod by 14 in. stroke. Fabricated frame. Table area 24 in. by 21 in. Daylight 24 in. Below fixed table; ejector ram D/a piston type 3 in. dia. by 2⅝ in. rod, by 4½ in. stroke. Self-contained Pumping Equipment, etc. W.P. 2 tons.

Two 100-tons Upstroke Presses by T. H. and J. Daniels. 12 in. dia. main ram, two side pullbacks by 12 in. stroke. Four columns 20½ in. by 10½ in. between. Table area 30 in. by 20½ in. Daylight 22¾ in. Each fitted with wire guards and Towler "Electraulic" Pump.

75-tons Upstroke Press by T. H. and J. Daniels. 8 in. dia. ram by two side pullbacks by 14 in. stroke. Four columns 14 in. by 9½ in. between. Table area 17½ in. by 14½ in. Daylight 24 in. Max. W.P. 1½ tons. Press self-contained with Towler "Electraulic" Pump, supply tank and control valve.

George Cohen Sons and Co., Ltd., Wood Lane, London, W.12. Phone, Shepherd's Bush 2070 and Stanningley, Nr. Leeds. Phone, Pudsey 2241. 196-9

MACHINERY, TOOLS AND PLANT WANTED

COMPRESSION MOULDING TOOLS WANTED. Send details of your surplus, obsolete and redundant moulding tools. Box P9117, care of "Plastics." 196-1020

WANTED. One inch screw extruder and also laboratory hot rolls, size 12-in. by 6-in. or 8-in. S. and J. Walsh (Plastics), Ltd., St. Lawrence Mills, Great Harwood, Lancs. Phone, Gt. Harwood 3121. 196-2

SECOND-HAND H.F. WELDER for making articles from P.V.C. sheeting required. Box P963, care of "Plastics." 196-x1430

HYDRAULIC OR PNEUMATIC PRESS required. Must be capable of thermo plastic mouldings 70-in. long and at least 24-in. wide.

Advertiser also requires hand presses for same type of work, capacity approximately 29 in. by 23 in. Write Box P9622, care of "Plastics." 197-1033

Machinery, Tools and Plant (contd.)

WANTED, Vacuum metallizing machine. Box P965, care of "Plastics." 196-37

INJECTION MOULDING MACHINES, 3, 4, 6 and 8 ounces in good condition. Apply Box P9614, care of "Plastics." 196-28

ONE- AND TWO-OUNCE injection moulding machines required. All particulars to Box P9624, care of "Plastics." 196-15

MOULDS WANTED

WANTED for export, new or second-hand injection moulds for electrical accessories such as switches, bell pushers, etc.

To fit 50-ton press. Please submit offer to: Elias I. Moradoff, 61 Gresham Gardens, London, N.W.11. 196-43

PACKING MATERIALS

PACKING MATERIALS for all requirements: Cardboard cartons, all sizes, available immediate delivery. Assorted sizes, once used, containers certified, 20 to 30 lb., 3d. each; 30 to 60 lb., 4d. Inquiries welcomed. B. K. Ghose, 8 Honor Oak Rd., S.E.23. For 6133. 201-1030

PATENTS

DESIGNERS—INVENTORS—PATENTEES.

We are always open to consider ideas, suggestions and propositions for compression mouldings. Write Box P9516, care of "Plastics." 197-1023

NEWLY DEVELOPED, patented commodity with enormous marketing possibilities for disposal on royalties. Sole production and marketing rights for British Empire excluding Canada, Australia and India. Sold retail at ca. 3s. through ironmongers and hardware shops. Apply Box P964, care of "Plastics." 196-38

PRODUCTION CAPACITY

PLASTICS (MANCHESTER), LTD.,

BRITAIN'S LEADING STOCKISTS AND DISTRIBUTORS.

SPECIALISTS IN

FABRICATION, INJECTION MOULDING AND ENGRAVING.

11 WHITWORTH STREET,

MANCHESTER, 1.

Central 7081-2 and Central 1000. zzz-0316

INJECTION MOULDING by I.O.G. Industries, Ltd., 41 Marshgate Lane, Stratford, E.15. Maryland 2804. 196-3243

REPETITION in Ebonite, Erinoid, etc. Capstan lathe work. Mansell, Temple St., Rugby. 197-3288

SMALL INJECTION moulding capacity and up to 3 oz. available at keen rates. Box P866, care of "Plastics." zzz-449

SHORT RUNS A SPECIALITY; LONG RUNS A PLEASURE. Low mould costs and overheads. Injection capacity and technical knowledge at your service. Westminster Plastics, 367 High St. North, London, E.12. Grangewood 3777. 199-3388

INJECTION MOULDING CAPACITY available. Low mould cost, speedy delivery. Foley Plastics, Avery House, Avery Row, W.1. Mayfair 6922. zzz-455

INJECTION MOULDINGS AND PLASTIC COVERINGS in acetate, alkathene, p.v.c., machined parts in brass, steel and plastics. After 40 years in Birmingham we now have extra capacity at our new factory and solicit your inquiries. F. A. Ketch and Son, Ltd., Trent Valley Works, Lichfield, Staffs. zzz-451

GAL-LACTIC FOR PLASTICS, Repetition in casein, ebonite and paxolin for autos and capstans, mouldings in Welvic paste, fabrications in polyester resins and fibre glass, Perspex; also light engineering and assembly. Galactic Works Co., Ltd., Linthouse Lane, Wednesfield, Staffs. 197-1021

DINES PRODUCTS, Stanley Rd., Grays, Essex, for injection mouldings. 200-3329

INJECTION MOULDING CAPACITY available up to 3 oz., precision moulding a speciality. Guardian Plastics, 76 and 77 Rahere St., London, E.C.1. 197-3287

MODERN PLASTICS, LTD.,

FOR

PLASTICS MOULDINGS

OF ALL TYPES.

CAPACITY AVAILABLE.

CORONATION WORKS,

KANGLEY BRIDGE ROAD, LOWER SYDENHAM, S.E.26.

Phone, Syd 5120. 196-42

Production Capacity (contd.)

KINGSTON PLASTICS, LTD., Unity Works, Union St., Kingston-on-Thames. Manufacturers of virgin and second-grade cellulose acetate moulding powders, matched to customer's own requirements for colour and flow. Customer's own waste also reprocessed to specified requirements. Sorting and grinding incorporating magnetic separation of metallic particles of all thermoplastics undertaken. Phone, Kingston 8405. 201-1031

METALTREAT, LTD., Canal Rd., Bradford, Yorkshire, are now able to undertake electro-plating or brightspray metallizing of plastics, glass and other materials. 197-1029

INJECTION MOULDINGS IN THERMOPLASTICS. Moulding in styrene, acrylics and acetate. Design and toolroom facilities available for mould construction. Inquiries invited. J. and E. Courtenay, Ltd., 138 Stratford Rd., Birmingham, 11. 201-1032

GOLD, SILVER and all metallic finishes on plastics, glass, etc., Alma Plating Works, Ltd., 5-7 Broadway Mews, Bowes Rd., N.13. Bow 5151. 196-40

RAW MATERIAL.

ALWAYS LARGE STOCKS OF
CASEIN
RODS, TUBES AND SHEETS.
PERSPEX
SHEETS UP TO 1 in. THICK.
CELLULOSE ACETATE
CATALIN RODS.
S.R. (PLASTICS), LTD.,
93 ALDERSGATE STREET, E.C.1.
Phone, Monarch 4686. zzz-445

A. E. GOODEVE, LTD., offer immediate deliveries of ebonite casein, laminated Bakelite in rods, sheets and tubes. Also cellulose acetate tubing, clear and coloured. A. E. Goodeve, Ltd., 188a Seven Sisters Rd., N.7. Archway 3654. 199-3389

ACETATE SHEET, clear or coloured, Crinothene and lampshade materials surplus stocks bought for cash. Dannell Coward, Ltd., 7 Earnshaw St., London, W.C.2. Tem 7317. 196-1022

2,000 GALLONS OF I.C.I. SPRAY WEBBING AGENT. Sprays fine threads! For spray packaging; for making hollow illuminated figures and signs; for making light reflectors and shades of unusual shape; for plastic ceilings and roofs. In 5-gallon drums only. 20s. per gallon, carriage paid: 10s. per gallon for the lot. Williams, 203 Albany St., London, N.W.1. Euston 4804. 198-1026

PERSPEX! PERSPEX!! PERSPEX!!! Official stockists for I.C.I. acrylic sheets. Sheets cut to your requirements. Fabrication and mounting specialists to the trade:—
S. C. Errington (Hanwell), Ltd., 132a Uxbridge Rd., Hanwell, London, W.7. Phone, Ealing 5288. zzz-460

PLASTICS (MANCHESTER), LIMITED,
BRITAIN'S LEADING STOCKISTS
OF
PERSPEX SHEET, ROD, TUBE.
11 WHITWORTH STREET,
MANCHESTER, 1.
Central 7081-2 and 1000. 196-7

RECLAIMED ACETATE X-RAY FILM, slightly blue tinted, finest quality first grade material, sizes 12 in. by 10 in., 15 in. by 12 in., 17 in. by 14 in. Immediate delivery, continuity of supplies guaranteed. Samples and prices from Lloyd's, 2 High St., Christchurch, Hants. Phone 504. 198-1028

SURPLUS CELLULOSE ACETATE MOULDING POWDER, black, 2½ tons, available at 2s. per lb. Box P9522, care of "Plastics." 196-39

ACETATE SORTERS of long standing have regular supplies of acetate cuttings (textiles), all colours separate, at very keen prices. Box P967, care of "Plastics." 196-35

WOOD FLOUR. Manufacturers who produce large quantities of shavings, turnings, sawdust and wood scrap from kiln-dried beech-wood, wish to form connections for disposal to consumers, in the form of wood flour or to make connections with the object of utilization of this material. Box P969, care of "Plastics." 196-34

INJECTION- AND COMPRESSION-MOULDING POWDERS, below works price, for disposal. Please inquire for particulars, Herbert Connor Ltd., 120 Beaufort Park, Falloden Way, London, N.W.11. 196-17

DIAKON, Grade LA, transparent pastel shades, small surplus lot cheap for sale. Write Box P9619, care of "Plastics." 196-18

FORMALDEHYDE MOULDING POWDER, black, Bakelite X4980 for sale. Box P9621, care of "Plastics." 196-19

PHENOLIC MOULDING POWDER, large surplus "Cabinet Grade" for disposal. Please write for details to Box P9617, care of "Plastics." 196-24

5-MM. WHITE COBEX SURPLUS to requirements in new sheets. Inquiries to Box P9625, care of "Plastics." 196-14

RAW MATERIAL WANTED

WANTED, Polythene scrap. Write to Box P7416, care of "Plastics." zzz-0322

SCRAP. Offer to:—
Michael S. Stevens, Keswick Works, Putney, S.W.15. Vandyke 3345. 196-3242

PROMPT CASH OFFERED for virgin and reprocessed cellulose acetate and polystyrene. Give manufacturer's name and packing. Box P873, care of "Plastics." zzz-448

P.V.C. GARMENT AND HANDBAG OFFCUTS wanted. We collect and pay cash. Brockwell Plastics, Ltd., 50 Hollingbourne Rd., S.E.24 zzz-36

OFFCUTS, PERSPEX, required, ⅛ in., clear or coloured, 1/16 in. clear, minimum width 2 in. Details to F. Blok, 88 Bedford Hill, London, S.W.12. 196-x6552

Raw Material (contd.)

SCRAP.
ALL PLASTIC SCRAP
AND CUTTINGS BOUGHT.
BEST CASH PAYMENTS.
J. W. NASH AND CO., LTD.,
27 BEETHOVEN STREET, W.10.
Ladbroke 3555. zzz-459

ERLANOS, LTD., 93 Aldersgate St., E.C.1 (Monarch 4686) require Perspex and cellulose offcuts and scrap, clear and coloured, highest prices paid. 206-3330

SURPLUS STOCKS of thermo-setting moulding powder wanted. Send details Box P864, care of "Plastics." 197-1019

POLYTHENE NATURAL, scrap, lumps, reground and virgin wanted. Please offer with samples and particulars to Herbert Connor, Ltd., 120 Beaufort Park, Falloden Way, London, N.W.11. 196-20

ADVERTISER, manufacturing industrial waterproof, invites samples of P.V.C. material suitable for this type of garment. Gloverall, Ltd., 30 Cricklewood Broadway, N.W.2. Gladstone 1056. 196-44

POLYSTYRENE, clear and coloured, scrap, lumps and virgin, continuously large quantities required. Please send detailed offer to Herbert Connor, Ltd., 120 Beaufort Park, Falloden Way, London, N.W.11. 196-23

ACETATE SHEETING, clear and transparent light colours from .005 in. to .020 in. thickness, any surplus lots urgently wanted. Please offer with particulars and samples Box P9615, care of "Plastics." 196-22

MOULDING POWDERS. We are always buyers of large quantities of injection and compression moulding powders. Please offer with particulars to Herbert Connor, 120 Beaufort Park, Falloden Way, London, N.W.11. 196-21

REPRESENTATION

TECHNICAL SALES REPRESENTATIVE required to undertake market research, marketing and technical services for the following products:
Rigid P.V.C. piping. P.V.C. shrink sleeving. Plastics bottles.

Only applicants with several years' experience in the plastics industry, aged under 40, will be considered. Successful applicant will receive adequate remuneration according to qualifications and experience, with use of car. Contributory pension scheme.

Applications should be in writing giving details of qualifications, experience and salary required to: Sales Manager, Lacrinoid Products, Ltd., Gidea Park, Essex. 196-5

LARGE INJECTION MOULDING COMPANY, London area, require services of outside representative with knowledge of custom moulding, toy, fancy goods and export trade, in usual thermoplastic materials, position offers scope to right person, good salary, pension scheme and car provided. Fullest details in strictest confidence stating age, experience and present salary Box P968, care of "Plastics." 196-29

SITUATIONS VACANT

The engagement of persons answering advertisements in respect of vacant situations must be made through a local office of the Ministry of Labour, or a scheduled employment agency if the applicant is a man between the ages of 18 and 64 inclusive or a woman between the ages of 18 and 59 inclusive, unless he or she, or the employment, is excepted from the provisions of Notification of Vacancies Order, 1952.

A LARGE ENGINEERING ORGANIZATION with United Kingdom and overseas interests invite applications for the following posts:—

1. Highly qualified production executive with experience in the extrusion of plastics. Knowledge of the manufacture of glass fibre products would also be an advantage. The candidate must be capable of initiating development work, have a sound knowledge of the plastics industry and be able to take charge of a new factory. A salary of £2,000/£3,000 per annum will be paid to the successful candidate, but this will depend to a large extent on ability and experience.

2. Highly qualified production/development engineer, experienced mainly in the extrusion of plastics. Knowledge of the manufacture of glass fibre products would be an advantage. Salary £1,500/£2,000, but this will depend on experience and ability.

3. Experienced technical sales staff with particular knowledge of extrusions. Salaries will be commensurate with experience.

An excellent pension scheme is in operation.

Candidates, whose applications will be treated in the strictest confidence, should supply in the first instance full details of present salary, age, industrial experience, technical qualifications and education, by writing to Box P2524, care of "Plastics." 196-1024

EXTRUSION-P.V.C. AND POLYTHENE CABLES.

Foreman wanted possessing full technical knowledge, long experience and drive. Small modern shop; good opportunity and wages for first-rate man. State age, qualifications, previous jobs, salary, to Box 644, L.P.E., 110 St. Martin's Lane, W.C.2. zzz-457

FOREMAN required for shift work in N.W. London plastic moulding company, must have sound experience of compression moulding; knowledge of injection moulding an advantage.

Write, stating full details of experience, age and salary required, Box P9626, care of "Plastics." 196-13

QUALIFIED CHEMIST required by important company engaged in the production of thermosetting materials. Applicants should have experience in a similar capacity and be capable of planning new developments.

Applications in confidence giving full particulars of experience to date and salary required. Box P9623, care of "Plastics." 196-16

FIBRE GLASS MOULDING. Moulders near London require experienced young man taking charge of department. Apply Box P9618, care of "Plastics." 196-26

Situations Vacant (contd.)

PLASTIC MOULD MAKERS with expert turning experience, etc., required for London factory. High salary rate and good opportunity for skilled men. Write full details of past experience to Box P9616, care of "Plastics." 196-27

JUNIOR DRAUGHTSMAN required. Experience in injection mould design desirable, but not essential.

Write stating age, details and salary required to, Bettix, Ltd., Elm Grove, Wimbledon, S.W.19. 196-1

DEMONSTRATOR required for injection moulding machines, possessing good practical and technical background.

Applicants with knowledge of hydraulics and plastics machines preferred. Good salary and splendid opportunity for advancement. London Headquarters.

Write in confidence giving fullest details training and experience, to Dowding and Doll, Ltd., 346 Kensington High St., London, W.14. 196-3

SALES MANAGER required for moulding and fabrication dept. Sales experience essential also knowledge of compression moulding, laminating and fabrication. High salary rate for experienced, keen and energetic man. Rate according to qualifications.

Technical sales staff also required. Excellent prospects and opportunity for experienced men. Candidates should mark letters accordingly and applications will be treated in the strictest confidence.

Apply Managing Director, Microcell, Ltd., 56 Kingsway, London, W.C.2. 196-4

SENIOR PROGRESS OFFICER required by leading plastics manufacturers; able to take charge of department and control material flow all stages from pressing to finished stores.

Write stating age, qualifications and experience, Box A.71, Willing's, 362 Gray's Inn Rd., W.C.1. 196-6

WORKS MANAGER required for London factory, applicant must have had large mass-production experience of woodwork items and/or plastic assemblies, highly paid situation and definite prospects for experienced man.

Write full details in confidence to Managing Director, Box P966, care of "Plastics." 196-36

LARGE COMPANY IN THE MANCHESTER AREA require plastics technologist for sales development work, age 30-35, knowledge of moulding techniques for reinforced thermosetting materials desirable.

Full details required in own handwriting, as preliminary to personal interview, to Box P9611, care of "Plastics." 196-32

PLASTIC MOULDING (compression). A vacancy occurs in old-established London factory for fully experienced foreman able to take complete charge.

Write giving full details of experience and present position, Box P9613, care of "Plastics." 196-30

SITUATIONS WANTED

MANAGER, INJECTION MOULDING, young, energetic enterprising, able to take complete charge of all phases, wide experience in toy and fancy goods, home or abroad. Box P9510, care of "Plastics." 196-12

EXECUTIVE ENGINEER, 39, seeks post with prospects, thoroughly experienced compression, injection transfer, sheet forming, laminates, mould design, plant layout. Allan, 281 Tudor Drive, Kingston, Surrey. 196-x1487

SALES EXPERIENCED YOUNG MAN, aged 23, requires position with small progressive firm. Box P961, care of "Plastics." 196-x1431

TIME RECORDERS

FACTORY TIME RECORDERS. Service rental. Phone, Hop 2230. Time Recorder Supply and Maintenance Co., Ltd., 157-158 Borough High St., S.E.1. 197-3289

TRANSFERS

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